TECHNOLOGY

THE AEROPLANE and ASTRONAUTICS

JANUARY 29, 1960

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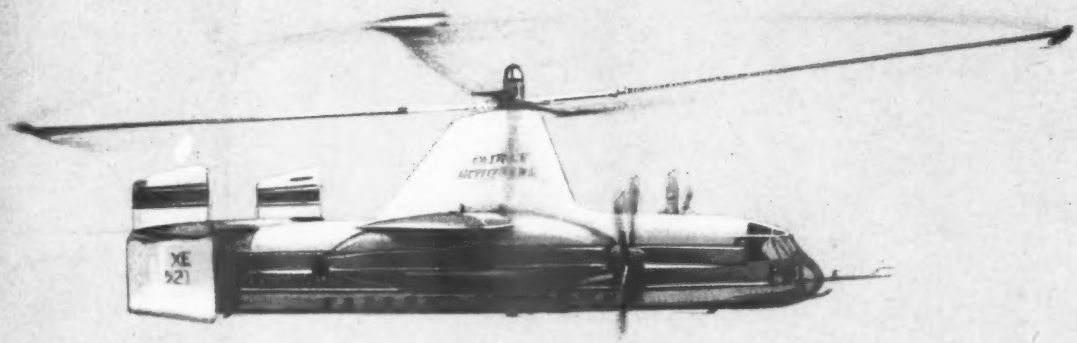

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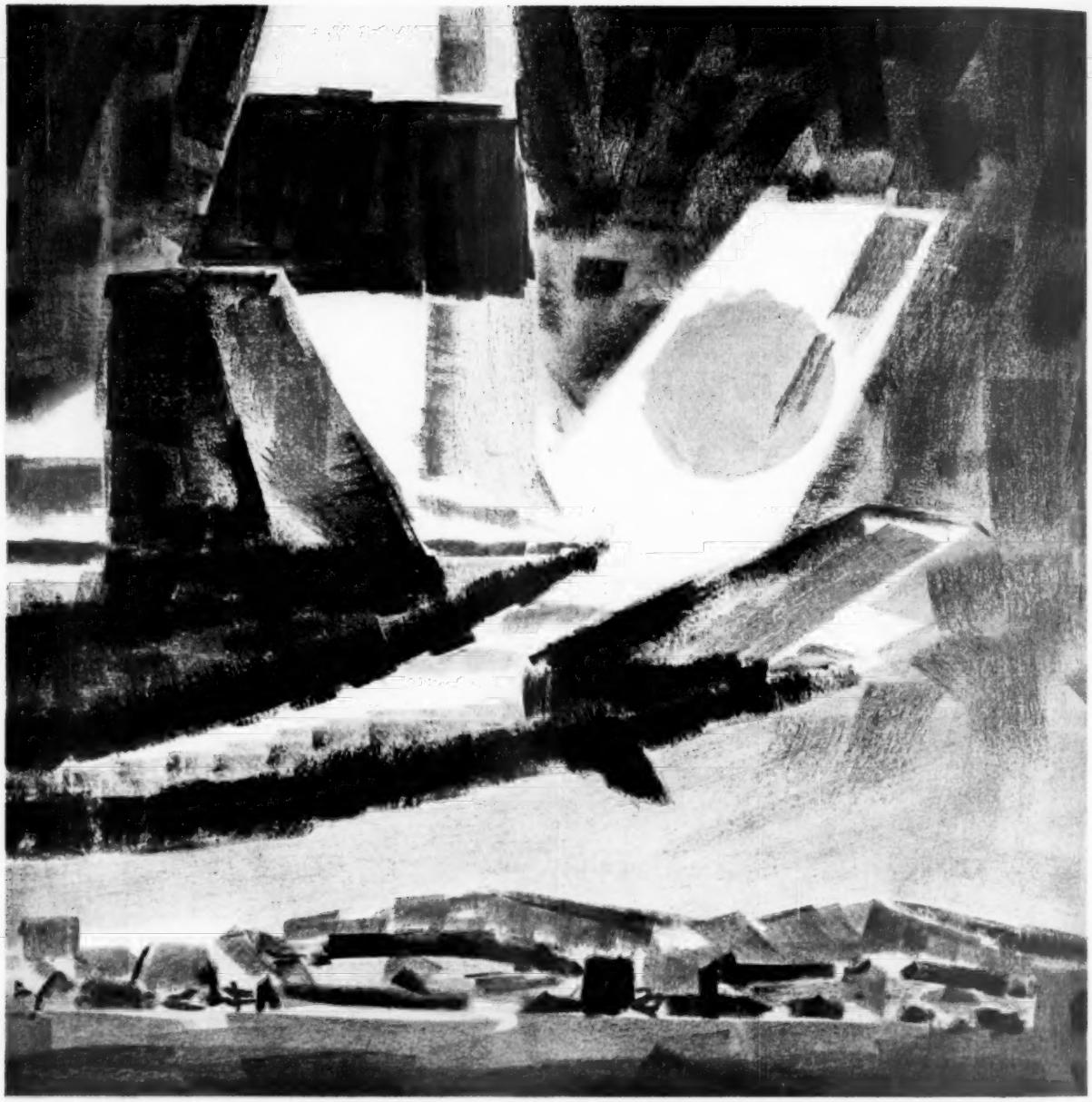

EN PASSANT

One of a series of drawings by Colin Munro

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THE AEROPLANE and ASTRONAUTICS

VOLUME 98 NUMBER 2519 JANUARY 29, 1960

The Incalculable Risk

The bomb scare in the United States may well have repercussions which could seriously trouble the airlines of the World. If nothing is done, then some passengers may be frightened into using surface transport; if the airline use baggage-search powers, then the resultant departure delays may nullify the time-saving advantages of air transport. Passengers will be lost to the airlines in either case.

Whatever the facts may eventually turn out to be about the two National Airlines crashes, it is disturbing to remember that there have been a relatively large number of bomb incidents and accidents during the past 10 years. Of the eight recorded cases of such outrages or attempted outrages, five were fatal.

What is needed is something like a Geiger counter but which would detect any type of explosive carried on board. Mine-detectors and X-ray apparatus would not be sufficiently selective.

End of a Deadlock

Airline nerves have at last cracked over the impending "open-rate" situation left over from the failure of last year's IATA traffic conferences. As we report on p. 130, a special composite conference is to be held as soon as possible. In a letter to member airlines, Sir William Hildred said that he believed that "conditions have sufficiently changed" to warrant this decision.

The reason for the change of heart is not explained, but it must be assumed that it is the result, at least partly, of British Government approval of lower fares on B.O.A.C.'s cabotage routes (which operate in parallel with those subject to IATA fare agreements) and of the likelihood that giants such as Pan American would have little hesitation in engaging, if need be, in a successful fare-cutting battle.

The decision to hold a meeting, and, as is probable, to extend, meanwhile, the period of validity of the 1959-60 fares, will not affect the individual decisions by airlines to discontinue the jet surcharge which was, in any case, too small to be effective as a differential and was the result of a compromise at the previous traffic conferences. It was agreed then that this surcharge could be lifted on March 1, 1960.

Meanwhile the year-old very-low-fare applications of Eagle and Hunting-Clan—which probably did as much as anything to cause the thinking which led to the international fares deadlock—remain unanswered.

Mountain Soaring Plans

As recorded in "Gliding Notes," permission has been received for a gliding expedition of four sailplanes and two powered towing aircraft (why do the gliding people not use the succinct phrase "air tug"?) to visit Nepal in the spring. Bases of the Mountain Soaring Group, which is organizing the expedition, will be at Katmandu and Pokhara. The aim is to collect operational and meteorological data for an attempt to soar over Everest in years to come.

Dr. Brennig James, M.B., B.S., leader of the Mountain Soaring Group, and his four associates, like himself, well-known sailplane pilots, have no illusions about the difficulties that will face them nor of the extent of the financial support required.

We imagine that there will be plenty of their countrymen to wish them well. To help the Group state their case we have invited Dr. Brennig James to write a special article for us which we hope to publish in our next issue.

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Matters of Moment

For the Fifth Year Running

PROVISIONAL estimates suggest that B.E.A. made a profit of about £2,000,000 during the 1959 calendar year. This sum is the figure arrived at after paying all interest charges and represents a profit of about 4% on the 1958-59 capital assets of the Corporation—and probably about 7% if allowance is made for the interest payments which have been deducted from the gross profit. This is a more than satisfactory result for a short-haul transport business which is made particularly difficult by heavy seasonal traffic variations, B.E.A. has now shown consistent profits for the past five years.

	Calendar year 1959	Calendar year 1958	% Variation
Capacity ton-miles offered	189,325,000	176,764,000	+ 7.1
Load ton-miles sold ..	126,444,000	106,175,000	+19.1
Revenue load factor (%)	66.8	60.1	+11.1
Passengers carried ..	3,207,000	2,760,000	+16.2
Passenger-miles flown ..	1,130,514,000	961,242,000	+17.6
Passenger load factor (%)	68.6	62.3	+10.1
Freight ton-miles	13,852,000	11,142,000	+24.3
Mail ton-miles	4,010,000	3,965,000	+ 1.1
Average staff numbers ..	12,008	11,485	+ 4.6
C.T.M. per employee ..	15,800	15,400	+ 2.6

The principal operating results, compared with those for 1958, can be seen in the table. The important features of the results are the passenger-total of 3,200,000 and the 24% increase in freight ton-miles. Writing in the *B.E.A. Magazine* Lord Douglas gives an "important measure" of credit to low inclusive tour fares for the passenger-traffic results and describes the profit as "a tremendous achievement."

More About the J-35B Draken

FURTHER information on the J-35B Draken has been released by SAAB. This is the export version of the J-35A and is in quantity production for the Royal Swedish Air Force; it has exceeded Mach 2.0 in level flight.

Powered by a Rolls-Royce Avon RB.146, the J-35B has a considerably improved performance compared with the earlier mark; both versions have an afterburner designed by Svenska Flygmotor AB. The RB.146, the latest military Avon, has a dry thrust of 13,220 lb. and has been developed from the RA.24 with an additional compressor stage. It was exhibited for the first time at last year's S.B.A.C. show, where it was fitted with a Rolls-Royce afterburner.

The main differences between the J-35B for the Royal Swedish Air Force and the export version are in the electronic equipment, which includes two VHF communications installations, a data link system and two navigation systems. The J-35Bs for Sweden employ special pilot guidance presentations operated by ground transmitters integrated into the Swedish air defence network and the SAAB S7 collision course fire control system.

Radar and armament fire control equipment in the export version is the Mark 2 Ferranti Airpass (Airborne Interception and Pilots' Attack Sight System). Intended for use in both interception and ground strike missions, Mark 2 Airpass has a number of special functions, such as "ground mapping," "contour mapping" and "terrain clearance." In ground mapping a map picture is produced on the radar scope, which at the same time can be used for the presentation of navigational information.

In contour mapping, the picture presented on the scope makes it possible for the pilot to detect contour differences in the terrain below and, when at very low level, in the surrounding terrain. The terrain clearance function permits low-level operation without ground visibility.

A Russian Dyna-Soar?

REPORTS circulating in the United States, quoting sources in Eastern Europe, suggest that the Russians may be testing a prototype of an "antipodal semi-ballistic missile" known as the T-4A. Although there is no confirmation of this at present, Soviet interest in boost-gliders has been suspected for many years, and as mentioned in our article, "Soviet Space Boosters" (THE AEROPLANE AND ASTRONAUTICS, October 9, 1959), the design study for a hypersonic rocket-bomber, produced in Germany between 1937 and 1942 by Drs. Eugen Sänger and Irene Bredt, apparently received Stalin's blessing soon after the War.

The T-4A is described as having a maximum range of 9,936 miles, operating at first as a ballistic missile but transforming its path into a hypersonic glide at a height of 186 miles. Maximum speed is quoted as 13,910 m.p.h. The vehicle is said to be catapult launched from a steel track by a rocket of some 300,000 lb.s.t.—similar in fact to the technique suggested by Sänger and Bredt. This, however, seems a trifle odd in these days of powerful multi-stage boost rockets.

A NATO Collective Design

COLLABORATION between the national aircraft industries in Europe has hitherto been largely confined to the interchange of engines and accessories, although NATO has steadily encouraged a more extensive programme of technical co-operation. This was reflected by the selection of the Fiat G.91 as a common lightweight ground-attack fighter, for NATO production in Italy and Germany, and the subsequent development of a standard maritime-reconnaissance aircraft.

The resultant Breguet 1150 Atlantic is the first truly international design project among the NATO countries, five of which are directly concerned with its development and production. As the suppliers of the powerplants, which are Rolls-Royce Tyne turboprops, the U.K. is also involved in the project, but responsibility for the supervision and financing of the programme has been jointly assumed by the Governments of Belgium, France, Germany, the Netherlands and the U.S.A.

The requirement for a NATO anti-submarine specification arose when replacements were sought for the Lockheed P2V Neptunes supplied under the U.S. Mutual Aid programme to several European countries. A group of technicians appointed by the various governments concerned held several meetings in 1958 under the auspices of the NATO Armaments Committee. Their purpose was to establish the technical specification of the new aircraft and to examine the design studies submitted by the aviation industries of the various countries.

No fewer than 25 designs were received for evaluation, and included an Avro project from the U.K. This was one of the three designs to be short-listed, the others being from Breguet and Nord Aviation, and the Br. 1150 finally became the unanimous choice of the evaluation group.

At that time, Avro had an agreement with Breguet to collaborate with the selected design, but as the British Government intimated its preference for the Shackleton for the R.A.F., A. V. Roe subsequently decided to withdraw. As the NATO design has only two engines, it apparently does

INTERNATIONAL ATLANTIC.—The Tyne-powered Breguet 1150 Atlantic is being designed and built by a five-nation NATO group for anti-submarine and maritime reconnaissance duties.

not conform to Coastal Command policy for long-range maritime patrol aircraft.

For project management, the participating governments have delegated their authority to a Steering Committee, and the actual work of construction is being undertaken under the executive supervision of the French *Direction Technique et Industrielle de l'Aéronautique*. With overall responsibility for the design, Breguet, directed by General Ziegler, has an engineering group at Villacoublay, led by M. Ricard and M. Gaillard, to co-ordinate the international activity.

Detail design, however, of the airframe as well as its production is being done by the companies concerned, which comprise Breguet, for the main fuselage, final assembly and development; Fokker, centre wing and engine nacelles; Dornier, rear fuselage and tail; and the Belgian ABAP consortium, including Avions Fairey, SABCA and Fabrique Nationale, for many fuselage components. The outer wings are the responsibility of Sud Aviation, in France, where the undercarriage is being produced by the Hispano company.

The Atlantic, as the Br. 1150 has been named, is powered by two Rolls-Royce Tyne 20 turboprops, each developing more than 6,000 s.h.p., through the medium of de Havilland propellers. Much of the electronic equipment is being supplied by the United States. Apart from wing-tip and fin-top fairings, no possible accommodation for radar is shown in the accompanying drawing, but it is reasonable to assume that a massive ventral fairing will manifest itself in due course. This artist's impression also shows the overall layout to be orthodox with a low/mid wing position and a single fin with extended dorsal strake.

A statement of possible significance in the preliminary release on the Atlantic is that for production aircraft, broader arrangements, not only for the airframe, but also for engines and equipment, are to be discussed. Prototype construction is proceeding satisfactorily, and interested members of NATO will shortly be invited to give their views on likely orders so that production arrangements may be made. It is probable that several other countries, in addition to those participating in its design, will operate the Atlantic.

The prototype should fly next year, probably at the Breguet Toulouse factory. Its leading particulars are: Span, 124 ft.; length, 90 ft.; height 35 ft.; wing area, 1,292 sq. ft.; gross weight, 86,000 lb.

Photograph copyright "The Aeroplane and Astronautics"

STARTING A SERVICE.—Mr. Duncan Sandys, the Minister of Aviation, and his daughter, board the B.O.A.C. Comet inaugurating the Corporation's new Latin-American service from London Airport on January 25. On the right is Sir Gerard d'Erlanger, chairman of B.O.A.C.

Moves and Counter-moves

OF late, public interest in aviation has been focused on the constructing side of the aircraft business. True, there has been some speculation about the future of B.O.A.C. with particular reference to changes in membership of the board. Gossip is now busy with names for specific jobs, including that of a full-time chairman; there are those who would not be surprised if the reconstitution of the aircraft industry were to make available such a titled chairman for B.O.A.C. Also it would not surprise many people if a prominent member of the Independent operators were invited to assist the National Corporation.

Meantime the Independent operators continue to follow the trend and to group themselves the better to take advantage of the situation which it is firmly believed will arrive when the new Minister of Aviation makes more competition for the National Corporations possible. As the news of B.E.A.'s profit shows, the Independents will have to show themselves extremely well run to compete.

However, some competition for B.E.A. could come from a rather less obvious direction. There was news last week of the acquisition by Airwork of Bristow Helicopters. As a result, Airwork will have a rotary-wing fleet as large as that operating anywhere of which we have knowledge, except perhaps Okanagan in Canada. It would indeed be interesting if the steady build-up in business by Bristow Helicopters from the Westland heliport at Battersea were to develop into those scheduled helicopter services which have for so many years been unavailingly awaited from B.E.A.

But whereas there has been news of a helicopter merger on the operating side, there has been no further news on the aircraft constructing side since Westlands gathered the Bristol Helicopter Division under their wing. With this move, Westlands considerably strengthened their design side already fortified by the acquisition of the Saro team. However, although it could be said that Saunders-Roe were the direct inheritors of the Cierva Autogiro tradition, it had been left to an aircraft firm with no prewar experience of rotary-wing aircraft to produce the revolutionary Rotodyne. There can be no doubt that the Fairey Company achieved a World First with the successful development of what understandably has become known as the first VTOL airliner. Today, most commentators feel that its continued development will only be assured if the team associated with its development join those at Westland or perhaps gain the backing of the Hawker Siddeley Group.

Should the much diversified Fairey Company decide to part with its aircraft division, the problem remaining to be solved is how would the experimental work associated with the Fairey Delta be handled. Work on its modification is an essential part of development towards the supersonic airliner.

Curiously enough, it is another firm, about whose future speculation is also busy, which has been getting on with the job of building an important experimental prototype delta, namely Handley Page, Ltd.

It seems to be assumed that the new consortium being organized by Vickers, English Electric and the Bristol Company is likely to be involved in the next stage of investigation into the supersonic airliner. No doubt this assumption is based on the fact that Bristol have been busying themselves for so long on the all-steel experimental prototype, the 188. We shall be surprised if the vast resources of the Hawker de Havilland Group are not employed on such a vast project.

All this speculation is understandable; it shows in a welcome manner that the importance of certain projects to the future of British aviation is widely appreciated. We wish that more was heard of prototypes for the vitally important executive market or even of plans to build light aeroplanes. We have yet to hear it suggested that take-over bids are to be expected in the personal flying field yet here is where figures show a promising market to exist. Plans, it is widely known, are well advanced in one big organization now being reorganized to enter the lightplane market with new designs. These designs would have the same American engines, built under licence here, as will the new Short executive design. But it is always later than one thinks and lightplane prototypes need to be flying in the spring.

But there has been plenty of talk. Everyone is now waiting for the Minister's promised announcement. On what he has to say and the forthcoming demands of the Minister of Defence hangs the well-being of an industry now earning exports of £156 million a year and scheduled to retain more than 100,000 people on its strength. And most of them have votes!

Back to Latin America

SPECIALIST in Latin-American affairs for many years Dudley S. G. Honor has been appointed company representative in Latin America by Canadair, Ltd. He reports directly to Peter H. Redpath, vice-president for sales.

For the past seven years Dudley Honor has been the representative in Latin America for the Bristol Aeroplane Company. Before that he had been the British civil air attaché in Buenos Aires, accredited to seven South American nations, a post to which he was appointed in 1948.

Before leaving the R.A.F. with the rank of Group Captain and the D.F.C., Dudley Honor had been military air attaché in Colombia, Venezuela and Ecuador.

Canadair, Ltd., are the Canadian subsidiary of General Dynamics Corp.

The Physical Society Show

AMONG the exhibits on the 140-odd stands at this year's Physical Society Exhibition at the Royal Horticultural Society Halls, Westminster, between January 18-22, were a number of items of aeronautical interest. These ranged from developments in airborne computers to new ground test equipment.

Under this latter heading was the new portable pitôt/static test set developed by Kelvin and Hughes in collaboration with the Ministry of Aviation. Where a suitable aircraft pitôt head is fitted, the test set can be used for checking altimeter, A.S.I., and Machmeter without the necessity of breaking or interfering with the pitôt/static system. Its operating range covers altitudes up to 100,000 ft., I.A.S. of 80 to 750 knots and a limiting Mach number of 1.13 at sea level.

This company also exhibited a true-airspeed computer which replaces the earlier air mileage unit. Being adapted as an air data computer for the D.H. 121, this unit measures the pitôt pressure, static pressure and airflow temperature, and from these parameters computes T.A.S., Mach number and air miles flown. Other Kelvin and Hughes products at the show included a new barometric switch and a miniature force balance unit.

Sangamo Weston, Ltd., exhibited a jet pipe temperature test set developed for the checking and calibration of gas-turbine temperature control equipment and indicators without having to disturb the aircraft's circuits. The leads from the test set are plugged in a test point built into the aircraft, so that it makes contact with the thermocouple system; removal of the plug restores the system to its normal operating condition.

Present trends in the scope and development of specialized tubing were illustrated on the stand of Accles and Pollock, Ltd., with tubing in special metals and such items as semi-flexible and thin wall tubing. Ferranti, Ltd., exhibited aircraft inverters for use with electrical gyro instruments, and primary activated batteries, consisting of pre-charged silver zinc cells which can be stored for long periods, were on the Venner Accumulators, Ltd., stand.

Burndept, Ltd., showed a VHF/UHF portable power meter suitable for checking output measurements of radio transmitters such as air/sea rescue beacons and any low, modulated power levels in these wave bands. A supersonic wind-tunnel for instructional purposes was shown by Optical Works, Ltd., in co-operation with Plint and Partners, Ltd.; operating on the induction principle from an air compressor and reservoir, its maximum Mach number is 1.8.

Test Pilot and Sportsman

AIR COMMODORE JOHN STANLEY CHICK, M.C., A.F.C., who died in hospital at Colchester aged 62, on January 21, was well known in the aeronautical community in his younger days because of his keenness as a participant at light aeroplane competitions.

He was born in Wales in 1897 and educated in Glamorganshire. After serving in the ranks of the Royal Engineers in World War I he was commissioned in the R.F.C. in 1917. He went to France as a pilot to join No. 11 Squadron who had Vickers Gun-buses at first and while flying with this squadron was awarded the M.C. in May, 1918. He obtained a permanent commission in the R.A.F. in 1919.

I first remember him as an enthusiastic voluntary helper at the 1922 Gliding Contest at Itford Hill. When the light aeroplane competitions were held at Lympne in 1923, '24, and '25 he was again much in evidence in a voluntary capacity. At this time he was a test pilot with the R.A.E. at Farnborough and as a result of his interest in the Lympne flying meetings was largely instrumental in forming the R.A.E. Flying Club.

That club is best remembered for a small mid-wing monoplane, the Hurricane with Bristol Cherub, which Johnny flew to victory at an average speed of 81.19 m.p.h. in the Grosvenor Cup race in 1925, a 100-mile cross-country race.

After leaving Farnborough he was posted to the Marine Aircraft Experimental Establishment at Felixstowe when the R.A.F. High Speed Flight was being formed there as challenger for the Schneider Trophy. For his work at Felixstowe he was awarded the A.F.C.

He was a Grade A flying instructor and in 1927 was posted to the C.F.S. as an instructor and in 1931 he passed a course at the R.A.F. Staff College and later served on the Staff of Air Defence of Great Britain the forerunner of Fighter Command.

When war came in 1939 he was a Wing Commander and he went to Rhodesia in 1940, as a Group Captain, to organize the Empire training schools in that country.

Johnny Chick will be remembered as a good sportsman, a great character and an enthusiastic rugger player, a sport he learned in his youth in Wales. He was a magnificent pilot in his day.—G.D.

Building up a Helicopter Fleet

LAST week's announcement of the purchase by Airwork of the share capital of Bristow Helicopters may be considered as an indication of coming developments as well as a logical step in the expansion by Airwork of its spheres of influence. It is likely that during the next few months there will be further alliances amongst the independent operators to meet the expected Ministry revision of policy in which suitably experienced and equipped organizations may be offered new opportunities.

The Airwork group of associates and subsidiaries now includes Air Charter, Morton and Olley Air Services, Transair, Bristow and Fison-Airwork as well as three overseas companies. With the Fison and Bristow interests the group's helicopter fleet totals 50 or more aircraft.

Mr. Alan Bristow will remain chairman and managing director of Bristow Helicopters, and his co-directors will be Mr. M. D. Wyatt (chairman and managing director of Airwork); Mr. F. A. Laker (chairman and managing director of Air Charter); Mr. G. Russell-Fry; Mr. A. G. Green and Mr. J. N. Woolley—the last three being former directors of Bristow Helicopters.

Formed in 1955, Bristow Helicopters is engaged in the operation of various types of helicopters and fixed-wing aircraft for a number of oil companies throughout the World in connection with seismic, geological and gravity survey work. Its associated company, Air Whaling, Ltd., was started in 1953 for the management of helicopters for the whaling industry.

In June, 1955, the company undertook the management of two Whirlwinds belonging to the Shell Petroleum Co., Ltd., and operated them in the Persian Gulf in connection with the Shell company's exploration programme based on Doha. During 1957 Bristow Helicopters started operating Widgeons for the British Petroleum Co., Ltd., in the Persian Gulf, and at the end of that year expanded its field to South America to operate three Bell 47G-1 helicopters on a general survey for Shell, in Bolivia.

The following year, the company was employed by Standard Oil to operate three Bell 47G-2s on a similar survey—also in Bolivia. Towards the end of 1958 it started fixed-wing operations with a Twin Bonanza on executive transport duties for an American oil company operating in Turkey.

Last year saw the start of transportation work by Bristow Helicopters with two Whirlwinds; this was in connection with off-shore oil drilling in the Persian Gulf. Expanding its activities in Bolivia, the company plans to operate a Beaver on oil survey and general charter work.

In this country it operates two Widgeons from the London Heliport and is aiming at expanding its executive travel facilities in the U.K. Because of the steadily growing use made of its London Heliport services, the company is transferring its base from Henstridge Aerodrome, Somerset, to Redhill Aerodrome early in March. Bristow's present helicopter and fixed-wing fleet comprises 10 Whirlwinds, six Widgeons, seven Bell 47G-2s, one Alouette, a Beaver and a Twin Bonanza.

Radar "Angels" Not Birds?

A PIGEON gives a radar echo equivalent to 100 sq. cm. of reflecting surface when broadside on, but equivalent to only 1 sq. cm. if end-on (either head or tail) to the beam, according to experiments by J. Edwards, of R.A.E. Farnborough, and E. W. Houghton, of the Royal Radar Establishment, which they describe in a letter to *Nature*. But in a discussion at the Royal Meteorological Society recently on a paper by R. F. Jones, of the Meteorological Office, one speaker declared that, if all the unexplained "angels" seen on PPI radars were due to birds, "the aeroplanes at London Airport would be very messy."

The echoes, when there is no precipitation to explain them, commonly show on the display as small dots, usually confined to a single level at not more than 5,000 ft., and in Mr. Jones' experience they move in the general direction of the wind but faster—often twice as fast.

He suggested, therefore, that the echoes come from ground objects but that the beam in both directions, there and back, is reflected from a small but sharp "atmospheric inhomogeneity" above the ground, consisting of a sudden change of humidity within a vertical distance of less than a foot. As this inhomogeneity moves at the speed of the wind, it would reflect echoes from a succession of stationary ground objects twice as far away; hence the "angel" would appear to be moving twice as fast as the wind.

But there is more to be explained. Mr. Jones proved that such a reflecting patch of air could not be higher than an elevation of 0.4° above the horizon in order to work, and therefore, to be near enough for detection, could not be more than 30 ft. high; yet "angels" appear on the display at far higher elevations.

Mr. Jones' proposed explanation is that the reflections are gathered in by the lowest portion of the weak "side lobes" which surround the main radar beam, while giving the false impression, when seen on the display, that the main beam is responsible for them. "Angels" tend to be most numerous around sunset and later, just when the atmosphere is becoming stably stratified so that inhomogeneities can develop.

So that is why the aeroplanes at London Airport are so clean.—A.E.S.

SEEING THE 748.—Recent visitors to Avro's Chadderton factory to see the 748 were Capt. L. B. Greensted, operations director, Hunting Clan Air Transport, Ltd. (left) and Mr. H. B. Cundall, chief development engineer, Hunting Clan (second from left). Explaining the aircraft's undercarriage here, are Mr. E. S. Greenwood, of Hawker Siddeley Aviation, and Mr. E. Galitzine, Avro sales manager (kneeling).

Research Facilities in Holland

ALTHOUGH the National Aeronautical Laboratory in Amsterdam has been operating its high-speed (Mach 1.3) wind-tunnel since the beginning of 1959, this useful piece of research apparatus was not formally opened until January 16 last. The ceremony was performed by Dr. A. H. C. Gieben, Secretary-General of the Netherlands Ministry for Transport and Waterways, representing the Minister.

Preparation of the tunnel has taken many years and in 1955, when plans were discussed the A.I.C.M.A. (Association Internationale des Constructeurs de Matériel Aéronautique), already decided to incorporate this tunnel in its research-scheme for the aviation industry on the Continent. This will mean that tasks undertaken will not be confined to those given by the national aircraft industry of the Netherlands. Industry and research institutes in other countries will make full use of the tunnel; Germany, for instance, will not duplicate it, but prefers to use the Dutch transonic tunnel.

It was stressed that, although speeds far in excess of Mach 1.3 are achieved, much research is required at speeds in the M=0 to M=1.3 range, which any vehicle must travel through during acceleration and deceleration. This also applies to manned satellite capsules, etc.

Area of the tunnel's working section is 5 ft. 4 in. by 6 ft. 8 in. Mach number is variable from 0 to 1.3, which corresponds to an airspeed range between 0 and 1,500 ft. per sec. Stagnation pressure in the tunnel is variable between 0.125 and 4 atmospheres.

Power to drive the tunnel is supplied by four turbo-generators which feed four 50,000 h.p. electromotors coupled to a common shaft. The motors drive a four-stage axial compressor; each stage consisting of 47 fixed stator blades and 22 rotor blades of adjustable pitch. Tunnel air speed is controlled by varying the pitch of these rotor blades at practically constant rotational speed.

The tunnel is of the closed circuit type and air leaving the compressor passes down a diffuser section, through two right-angle bends, and then through a cooler placed at the entrance to the settling chamber. Cooled air passes through a set of gauze screens to reduce turbulence of the flow and subsequently passes through a contraction section—of large contraction ratio

View of the high-speed tunnel of the National Aeronautical Laboratory at Amsterdam. The passageway to the test-section is seen on the left.

Matters of Moment . . . .

—and a Laval nozzle adjustable throat after which it reaches the test section.

Leaving the test-section, the airstream flows through the first two sections of the diffuser and, passing through two more right-angle bends, returns to the intake side of the compressor.

During subsonic operation, the airspeed in the test-section is entirely controlled by the pressure-ratio produced by the compressor. For supersonic operation, the throat has to be adjusted according to the Mach number desired in the test-section.

The tunnel can be operated at different pressure levels. A water-operated diffusion pump permits rapid evacuation of the entire tunnel to the desired value. For raising the tunnel pressure to above atmospheric, a multi-purpose compressed-air tank is used which can store 24,000 m^3—848,000 cu. ft.—of dry air at 40 atm. pressure. A 6,000-h.p. compressor with additional heater is provided for this purpose. Variation of pressure affords change in Reynold's number at subsonic speeds.

Measurement of forces and moments on models or parts is by means of internal strain-gauge balances. For pressure measurements liquid manometers are used. Distribution of normal pressure over the surface of the model is measured by means of a manometer consisting of 160 tubes. A completely automatic pressure measuring system, using pressure transducers and automatic input in the computer, is under development. Flow patterns can be observed by the Schlieren and shadowgraph system: all parts of which being mounted in a yoke which can be shifted and rotated with respect to the model.

With this transonic tunnel the N.L.L. possesses an admirable instrument for co-operation in international research and valuable advice was given during the planning stage by AGARD. In addition to this unit, a tunnel capable of speeds up to Mach 6 is available, while a tunnel for speeds up to Mach 4, with a working section of 4 ft. by 4 ft., has been ordered.

J. VAN H.

From Instructor to Works Manager

"ARCHIE" KNIGHT who died at Weybridge on January 17 aged 72, was well known in the aircraft industry.

Born Archibald Knight at Fairfield, Glos., he took his Aviator's Licence, No. 60, on February 14, 1911 when he was 23 at the Bristol Flying School at Brooklands. Soon afterwards he became an instructor at the Vickers Flying School, also at Brooklands. His colleagues were Harold Barnwell and Major H. F. Wood. The former became Vickers first chief test pilot and the latter became the founder of Vickers Aviation Department.

On the outbreak of war in 1914, Archie Knight joined the Royal Flying Corps and attained the rank of Sergeant Major before he was recalled from active service to join Maxwell Muller in managing the rapidly expanding works of Vickers at Weybridge, which had been opened adjacent to the Brooklands "Straight," in Sept. 1915. He held the appointment of works manager there until his retirement in 1936, but returned in 1939 for the duration of the second World War.

Recalling that he had been taught to fly by R. H. Barnwell and Archie Knight, the late Mr. Rex Pierson said in the course of a broadcast made in 1942 that "Archie Knight was a first-class instructor who believed in kicking any nervousness out of all pupils." He recalled uncomfortable moments when suddenly he would deliberately knock the joy-stick out of his pupil's hand. "That," he would say, "is to impress you with the effectiveness of the controls." It certainly did. "Incidentally," said Mr. Pierson, "he is the only man I have known who has been hit on the head by a propeller going full out, and surviving."

Cranfield's Contributions to Aeronautical Research

IN a post-graduate specialist college, it is only to be expected that research in some form or another would represent an important part of its overall programme of academic activity. In this respect, the College of Aeronautics at Cranfield can claim to hold a particularly useful place in its own special sphere, for the research done by the various departments of the College has usefully contributed to development and progress in a number of branches of aviation.

Last week, the Principal of the College, Prof. A. J. Murphy, M.Sc., F.I.M., F.R.Ae.S., delivered a main lecture to the Royal Aeronautical Society at the Cambridge branch. Appropriately enough in a place where much valuable aeronautical research has been done, he chose to describe similar efforts at Cranfield. And as one would expect from such a lecturer, the paper he presented turned out to be a masterly and comprehensive survey containing some 17-18,000 words.

As the lecturer explained, this consisted of contributions from the eight teaching departments and the library. Here, we can do no more than mention some of the work discussed.

In the Department of Aerodynamics the pioneering work done on jet noise has continued in both experimental and theoretical fields. Experiments at Mach 2 on the interference characteristics of low aspect ratio wings and cylindrical bodies have been done in the 9-in. by 9-in. supersonic wind-tunnel; this tunnel is now being used for research on jet-body interference and base drag at supersonic speeds.

The aerodynamics department has also done much research on the characteristics of slender wings and bodies at low speeds. The use of spanwise jet blowing on slender wings as a means of control and of increasing maximum lift has been demonstrated in tests on a swept wing and body of revolution—work is now in progress with a cropped delta wing. The problem of the jet flap with ground effect is also being studied.

Man-powered flight has figured prominently in the department's programme and the problem of power storage by stretched rubber has been the subject of detail research. Work done in other directions includes heat transfer in dissociated gases; ablation of surface material into the boundary layer; and magnetogasdynamics. Future research on hypersonic aerodynamics embraces the design of a shock tube with a maximum "driver" pressure of 1,000 atm.

In the Department of Aircraft Design, the majority of the special research investigations come under the headings of applied mechanics or structures. Kinetic heating effects; the special problems associated with undercarriage drop testing; vibration analysis; and helicopter ground resonance, are but a few of the areas covered in this research.

As would be expected the research interests of the Department of Aircraft Propulsion cover a wide field. They include investigations of the dynamic loading of gear teeth, bearing problems, and the whirling of complex rotors. Aerodynamic research in the department includes a study of the effect of ground proximity on the thrust delivered by an engine producing a downward jet. Rocket research subjects include the flow pattern of the reacting gases in a rocket combustion chamber and high-frequency pressure oscillations in solid-propellent rocket motors.

A study of the relationship between man-hours required for the manufacture of aero-engines and the number of engines made, comes within the province of the Department of Aircraft Economics and Production.

A comparatively new department in the College—that of Aircraft Electrical Engineering—is doing research into such things as network theory, computer techniques and microwave techniques. The main researches in the Department of Aircraft Materials are particularly related to the question of metal fatigue with such materials as the high-strength aluminium-zinc-magnesium alloys.

During the past few years some investigation of wavedrag of bodies in supersonic flow has been done by the Department of Mathematics. Methods for the numerical calculation of the drag of slender bodies and of lift and drag of wings at supersonic speeds have also been investigated.

In the Department of Flight, research into stability and performance problems plays an important part. For some years work has been done on the measurement of dynamic stability. Current research also includes tests on a Midge wing mounted above the fuselage of a Lancaster. A proposed programme covers research into artificially induced buffet on a Venom and research into rolling response with moving wing tips on the Short Sherpa.

The library at Cranfield, too, plays its research part. For the past 18 months, with the support of a grant from the U.S. National Science Foundation, it has been making an investigation into the comparative efficiency of various methods of indexing scientific and technical information.

Aviation News in General

LATEST RA.29.—The Rolls-Royce Avon RA.29, Stage 6 Mark 531, has been given full normal category approval for civil operation by the A.R.B.; deliveries of the engine will begin this summer. The engine, which delivers 12,200 lb. minimum guaranteed thrust, has an average take-off thrust of 12,500 lb. Stage 6 RA.29s power the Caravelle 6, four of which have been ordered by Sabena. Stage 3 RA.29s, of 11,700 lb. thrust are already being delivered for the Caravelle 3.

NEW BELL.—Latest in the range of Bell helicopters is the 47J-2 Ranger, shown publicly for the first time at an international convention of the Helicopter Association of America. It has a Lycoming VO-540 engine and is a four-seater with a gross weight of 2,850 lb.

B-58 CONVERSIONS.—The production conversion of a number of experimental B-58 Hustlers to tactical configuration has been started by Convair at Fort Worth. The 16 aircraft to be modified will be put into the conversion programme as soon as they have completed their test programme.

INDIAN SEA HAWKS.—The first Armstrong Whitworth Sea Hawk for the Indian Navy was delivered on January 22. Flown from Bitteswell to R.N.A.S. Lossiemouth, it was handed over to Cdre. R. B. Law, C.O. of No. 300 Squadron, I.N., by A.W.A. test pilot, Martin Walton.

SWEDISH CANBERRAS. — Two English Electric Canberra B.2s are at present being converted into mark T.11s (as radar trainers) for the Swedish Government. The first Canberras to be ordered by Sweden, they are designed for all-weather interception training and carry a crew of four.

VOLTIGEUR TEST.—The third prototype of the SE117 Voltigeur, powered by two Turboméca Bastan turboprops, made its first flight on January 21, at Marignane. The Voltigeur is a general-purpose Army support aircraft in the French "avions bi-moteurs polyvalents" category.

GUIDED POLARIS.—First firing of a Polaris missile with a full inertial guidance system was made from Cape Canaveral on January 7. The missile travelled a distance of 900 miles.

CUBAN MiLS.—A recent report by Moscow Radio announced that a number of Mil Mi-4 helicopters are to be supplied to Cuba. Similar helicopters have already been supplied to the United Arab Republic, in addition to most of the Soviet satellite air forces.

C.P.L. REDUCTION.—The cost of a Commercial Pilot's Licence course at Exeter Airport has recently been reduced from £625 to £605. This figure assumes the holding of a Private Pilot's Licence. The reduction results from a lower contract rate for the 100 hours of solo flying.

AUSSIE SATELLITE?—Plans to put Australia's first satellite into orbit are being considered by the Federal Government, according to Dr. Martyn of the Australian Academy of Science. He said the rockets to launch Australian satellites could either be built in Australia or overseas. This would be in addition to arrangements just completed to launch Australian instruments in a U.S. satellite.

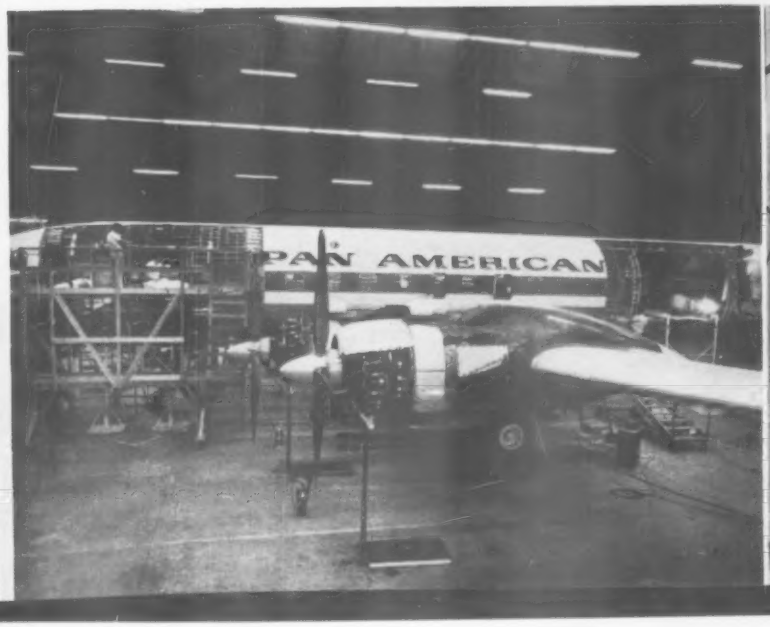
SATURN RE-STAGED.—The 1.5-million-lb. s.t. Saturn booster is now likely to be fitted with a high-energy second stage in place of the Titan-C first-stage, to enhance its performance. The new arrangement is likely to involve development of a liquid oxygen/liquid hydrogen engine of 150,000 lb. s.t.

LIVE RECOVERY.—Another test-firing of a full-size Mercury space-capsule on the nose of a Little Joe booster was made from Wallops Island, Virginia, on January 21. Inside was a female monkey, "Miss Sam," which was safely recovered after the capsule, having separated, had reached a height of seven miles and parachuted back into the sea.

LONG LIFE.—A Bell 47D helicopter has completed 10,000 hr. flying time; the company believe that this is the first time such a figure has been reached by a civil or military helicopter. The helicopter was first owned by Chicago Helicopter Airways and is now operated by Helicol—a subsidiary of Keystone Helicopters.

(*More News appears on page 144*)

CARGO CONVERSION.—Lockheed Aircraft Service has completed the conversion of 10 Pan American World Airways DC-7Cs to an all-cargo configuration. The large front and rear loading doors are seen top right; below right, the new interior with a heavy-duty floor to carry 300 lb./sq. ft. at 4.5*g*; below one of the conversions in progress.



Air Transport

Reopening IATA Fares Talks

A SPECIAL meeting is, after all, to be held by IATA members to try to avoid the "open-rate" situation which will otherwise emerge from April 1 on African, Asian, Australian, Pacific and North Atlantic routes. Association spokesmen had previously made it clear that no more fares talks would be held before the next annual conference unless there were indications of "a strong and unmistakable" wish among airlines to come to agreement. These indications have evidently been shown.

The first decision to be made by the special conference will be the extension of the period of validity of the 1959-60 fare structure over the routes which were the subject of differences. Sir William Hildred, IATA's director-general, suggests that this revalidation should cover a period of from 30 to 60 days. The conference is to be held "with an absolute minimum of delay," but the date and place had not been determined at the time of going to press.

The decisions, by B.O.A.C., T.W.A. and, earlier, by T.C.A., to remove the jet surcharge will not be nullified by the IATA decision because it was agreed during the previous year's conferences that the surcharge would positively apply only until February 29, 1960.

New York's Fourth Airport

OPPOSITION to the Port of New York Authority's proposed fourth airport for the New York area is growing, and is being co-ordinated by the Jersey Jetport Site Association. The Authority has proposed (as we reported in our issue for January 1) that the new airport, which will be required when the three existing airports reach saturation point in 1965, should be built in the Great Swamp area in Morris County. The suggestion is opposed by communities neighbouring the area.

The plan suffered a further set-back on January 18 when the New Jersey Legislature voted against it, and called for the new airport to be sited in Burlington County. This latter site, 55 miles from New York, has been rejected by the F.A.A. because of conflict with major airways and proximity to Philadelphia Airport and McGuire Air Force Base.

Eurocontrol Problems

VERY little has been said, so far, about the progress, or otherwise, of the talks leading to the provision of means for the control and co-ordination of civil and military air traffic in Europe. A series of recent meetings has been concerned with technical and administrative details, and there were bound to be difficulties—if only those of a non-technical nature concerned with national policy and finance.

Informed gossip suggests that the main difficulty may be concerned with the practical question of when and how a major air traffic control centre should be planned to look after western Europe. Apart from communication problems, the organization of such a centre would involve long-term decisions about the nature of the future A.T.C. methods, military and civil, which would need to be planned into the overall system and about the use, or otherwise, of NATO equipment and personnel.

Any technical differences of opinion may be concerned primarily with the basic philosophies of "automatic" A.T.C. systems, only two of which are at present under positive practical development. These are Holland's S.A.T.C.O. (see THE AEROPLANE of July 5, 1957) and the American F.A.A.-sponsored system (see our issue of November 6, 1959, pp. 434-435), the development of which is now also being followed in the U.K. by General Precision Systems (October 30, 1959, p. 418).

The Jet that is Different

HYPOTHETICAL Air Lines, in a hand-out introducing "the jet that is designed to be different," offers "a full half-hour of additional jet flight on coast-to-coast trips—at no extra cost" and promises its passengers prompt landings at destination "since our competitors' jets will already have landed and there will be much less likelihood of traffic delays."

This spoof Press-release, which has been causing a good deal of amusement on the U.S. West Coast, is a rather obvious dig at the Douglas DC-8. The fact that this aircraft is down on its specification speed and range performance is now well known (see "Speeding the DC-8" below) and Boeing 707 operators have been making the most of their temporary advantage. One T.W.A. captain, flying a Boeing 707 from Los Angeles to Washington, was credited recently with the following passenger announcement: "Ladies and gentlemen, if you will look out the right side of the aircraft, you will see in a few minutes one of the most beautiful sights in America—we are passing a DC-8 which took off from Los Angeles 10 minutes before we did."

Speeding the DC-8

ACCORDING to an article by Fred S. Hunter in the latest issue of *Airlift*, the version of the DC-8 now in domestic service with United and Delta, with JT3C-6 engines, has an actual level flight speed, at maximum cruising thrust, of 469 knots at 30,000 ft. at a weight of 220,000 lb. This compares with the specification speed of 493 knots plus or minus 3%. Actual range of this model, at its present certificated weight of 265,000 lb., with unspecified reserves, is 3,285 nautical miles.

The drag rise on the DC-8 at high lift coefficients has proved to be worse than the demonstrated wind-tunnel values, and becomes critical at Mach 0.84. Douglas has embarked on a series of modifications designed to reduce drag, which, together with the introduction of more powerful engines, are expected to bring the performance back to specification. These modifications will include 16-inch elliptical wing-tip extensions (for a 2% drag reduction); large fairings on the leading edge of each pylon, to smooth out the airflow (the drag peaks at the pylon-wing junction); vortex generators on the top wing; drooped flaps to increase the wing camber; ailerons with greater mass balance; and leading edge slots to maintain take-off performance at the higher gross weights associated with extra fuel.

Most of these modifications are being flight tested on the seventh DC-8, a Pan American model with 15,800-lb. JT4A-3 engines, and a speed of 509 knots has now been demonstrated against the 511 knots specified. The 16,800-lb. JT4A-9 engine is now becoming available, and will increase the speed to 510 knots. At 276,000 lb. gross weight, this version, with the modifications, is expected to have a range of 3,455 nautical miles. It seems, however, that the full specification performance of the domestic JT3C model (which has the highest power loading of any jet transport, at 5.06 lb./lb.s.t.) will be achieved only when the 17,000-lb.s.t. JT3D-1 turbofans are installed. With these engines, the cruising speed is, according to *Airlift*, expected to be 487 knots.

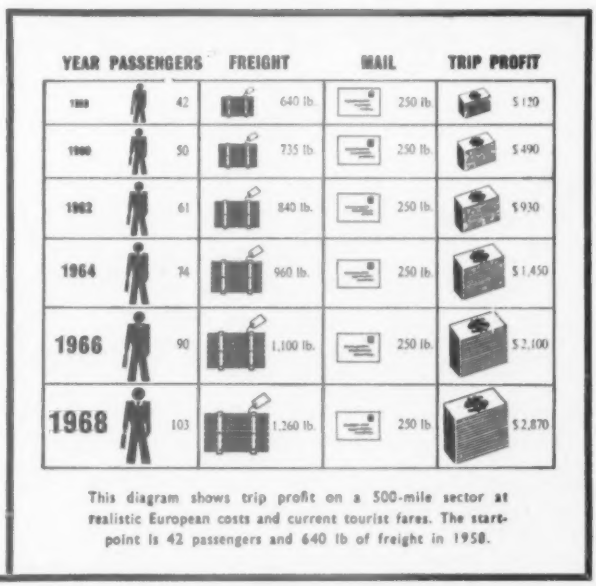
TEST FLEET.—Five Vickers Vanguards—four of them visible in this photograph—are now being used in an intensive dawn-to-dusk flying programme. The first of T.C.A.'s 20 Vanguards, which will be the eighth off the line at Weybridge, is due to fly in February.

Only the VANGUARD has this future while making money right from the start

THE VICKERS VANGUARD is designed for growing traffic, yet it will make profits right from its introduction with payloads no bigger than those carried by Viscounts today.

This is clearly shown in the illustration. Profit begins with the first 500-mile trip carrying no more than 42 passengers and 640 lb of freight. Even on modest estimates of traffic and freight increases, its profits will grow considerably with the years.

Assuming a 10% increase per annum in traffic, and 7% in freight, annual and cumulative profit at the end of seven years is remarkably high. By employing the Vanguard's cheap-fare possibilities, payloads and profits could be much higher.



This diagram shows trip profit on a 500-mile sector at realistic European costs and current tourist fares. The start-point is 42 passengers and 640 lb of freight in 1958.

Of all the airliners only the Vanguard has all these features

425 m.p.h. cruising • Freight capacity 7/8 tons at normal densities • Full routeing and A.T.C. flexibility • Can use normal existing airfields • Quick turn-round • No airfield noise problems • Ten years' unique Vickers/Rolls-Royce turbo-prop experience . . . ***And it is 'Viscount' quiet.***

VICKERS VANGUARD

FOUR ROLLS-ROYCE TYNE TURBO-PROP ENGINES

• ***The airliner with the biggest profit potential ever offered to the operator***

VICKERS-ARMSTRONGS (AIRCRAFT) LIMITED WEYBRIDGE SURREY

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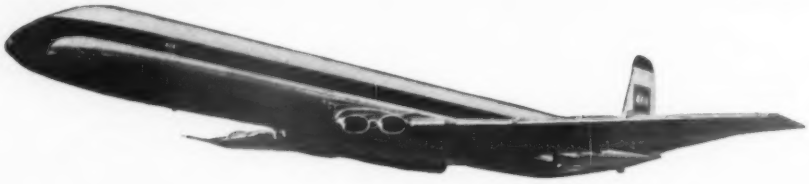

The latest triumph of Castrol research

BEA CHOOSE CASTROL 98 for all their jets

DO YOU KNOW that at any moment of the day or night, winter and summer, *an average of* 1,000 *BEA passengers are in the air in aircraft relying on Castrol* 98?

DO YOU KNOW that the Rolls-Royce Dart engine in the BEA Viscount '700' travels 625,000 miles in the 2,400 flying hours between engine overhauls? *What greater tribute could there be to the engineers who designed it and the Castrol* 98 *that lubricates it.*

DO YOU KNOW that a BEA Viscount uses 782 gallons of fuel to fly from London to Paris and back, but only four-fifths of a pint of oil for all its four engines?

DO YOU KNOW that each Rolls-Royce Dart engine in a BEA Viscount can deliver more horse-power continuously than Britain's most powerful express passenger steam locomotive? *Think what this means in terms of stressing inside the engine — stressing which Castrol* 98 *has been expressly developed to withstand.*

DO YOU KNOW that a BEA Comet flies most economically when it is cruising at 2,000 feet higher than Mount Everest?

DO YOU KNOW that a BEA Comet may take off at a ground temperature of 98° Fahr. and in 20 minutes will be cruising in an air temperature as cold as *minus* 58° Fahr.? *Under all extremes of engine working conditions, Castrol* 98 *is totally reliable.*

DO YOU KNOW that in one day BEA can have 350 aircraft arrivals and departures at London Airport alone? *Regularity of this order demands complete engine reliability.*

DO YOU KNOW that BEA serves more cities in Europe than any other airline? *And Castrol is available at them all.*

WAKEFIELD Castrol MOTOR OIL

The same brilliance of research which produced CASTROL 98 is devoted to every Castrol lubricant

That is why CASTROL Motor Oil is notably in advance in technical development. That is why every British motor manufacturer approves CASTROL. That is why each year more British motorists ask for CASTROL by name than for all other oils put together.

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Air Transport . . . .

Accident Trends—1959/60 and the Future

FOUR major air accidents in the first three weeks of 1960 have cost the lives of 163 passengers and crew. These accidents, including two involving U.S. domestic carriers, continue the upward trend of passenger fatalities which was seen in 1959. In addition to the crash of a National Airlines DC-6B (reported in our issue for January 15), a Capital Airlines Viscount flying from Washington to Norfolk, Va., on January 18, crashed some 50 miles short of its destination and burned, killing all 50 occupants; an S.A.S. Caravelle on the Copenhagen-Cairo service on January 19 crashed while approaching Ankara airport, killing all 42 occupants; and an Avianca L-1049G Super Constellation crashed on January 21 while landing at Montego Bay, on a flight from New York and Miami, killing 37 of the 41 occupants.

The fact that the DC-6B accident was almost certainly the result of a suicidal act by a U.S. lawyer—who was reported to be under investigation by the F.B.I. and who had insured his own life for about $1 million—will do little to reassure the travelling public (although it is a grim thought that this same act would have occurred in a Boeing 707 had a last-minute technical fault not caused National to substitute an Electra and the DC-6B on this service). Nor does the fact that no pattern of accident causes has emerged make it any easier to take quick or effective action to reverse the trend.

Both the F.A.A. and National Airlines were quick to deny, incidentally, that pilot's proficiency tests are in any way harmful to the aircraft in which they are made. As we reported last week, National pilots had refused to take proficiency tests following reports that the DC-6B broke up in the air.

In Washington, a Senate investigation panel is at present studying the record of commercial air accidents in the U.S.A. in 1959. Giving evidence before this panel, the chairman of the C.A.B., Mr. James R. Durfee, said that the fatality rate per 100 million passenger-miles increased from 0.38 in 1958 to 0.68 in 1959. Investigations showed the need for "renewed attention" to day-to-day airline operations, with special emphasis on personnel training and procedures. [New F.A.A. rulings on crew qualifications and training were described in our issue for January 1, page 7.]

In the last year for which data had been analysed—1958—personnel error factors had been responsible for 52% of all accidents, fatal and non-fatal, on U.S. scheduled airlines, with 28% attributed directly to pilot error.

ICAO statistics for accidents throughout the World in 1959 are not yet available, but there is no doubt that the 1958 fatality rate of 1.1 per 100 million passenger-miles will be worsened—by the American trend if for no other reason.

Whether the fatality rate figure moves up or down in 1960 and thereafter, it seems inevitable that the number of passengers killed while flying will continue to increase as the amount of air traffic itself goes up. In 1958, 604 were killed on scheduled air services; if the volume of air traffic increases to 150,000 million passenger-miles by 1970 (as has recently been forecast) then at least 1,650 passengers will be killed in 1970, even if the fatality rate is no worse than the 1958 figure of 1.1.

Two, Three, or Four?

THE reasoning which led Sud Aviation and, later, de Havilland and Vickers, to choose the rear-engined layout appears to have convinced the U.S. constructors and operators. It may well be that the D.H. and Bristol three-engined variant of this configuration (which also applied to the original X-210 pre-Caravelle project) will be found in the short-medium-stage turbojet transports which must eventually appear, as finalized designs, on the other side of the Atlantic.

The case for the trimotor certainly appears to be a good one and the de Havilland/Airco team started with an entirely open mind and reached the "more than two, but less than four engines" conclusion on the basis of the facts of the case. Obviously there can be no firm rule—and certainly none for aircraft in other categories—but it happens that, subject to the availability of a powerplant of the right performance, the three-engine layout fits the take-off and cruise thrust requirements of the short-medium-haul transport intended for operation out of 6,000-ft. airfields. In simplest terms, a twin in the 121 category is likely to be overpowered on cruise and a four-engined version would be overpowered on take-off.

Starting from first principles, the initial cost in relation to thrust required is least for the fewest number of powerplants. A single-engined design is obviously out, so the preference on this count would be for two engines. But calculations show that, when meeting design requirements for a 6,000-ft. balanced field length at sea level and I.S.A. +10° C., for a T.A.S. of 600 m.p.h. at 25,000 ft., and on stage distances of 500-1,000 miles, the total static thrust required by a twin is much higher than that required by a three- or four-engined aircraft. Over a stage distance of 800 miles the direct costs per mile, with 1 : 1 by-pass ratio engines, appear to be about 3% lower than for the twin—though similarly higher than a twin over stages up to, say, 550 miles, and higher than a four-engined aircraft over distances in excess of 1,300 miles.

In short, the three-engined aircraft offers a balance of thrust requirements for the designed take-off distance and cruise speed while offering the best economics for ranges of 500-1,000 miles. Coupled with the natural wish of passenger-sales, operations and flight staff to have as many engines as possible, and with the preference, as a minimum, for triplicated hydraulic and electrical systems, the choice was almost inevitable—subject to other design and engineering factors, and to the acceptance of the advantages of the rear-engined layout which makes a trimotor a practical possibility.

Among the possible adverse factors were maintenance problems, intake losses, the possibility of turbine-disc-failure damage, crash dangers, C.G. difficulties and structure weight.

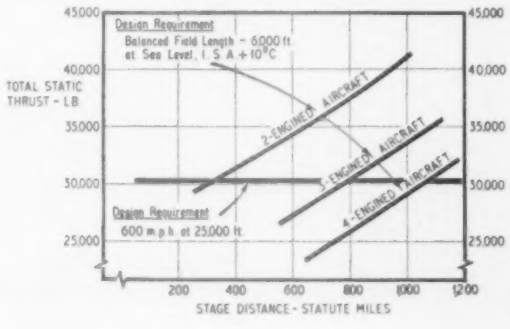
So far as day-to-day maintenance is concerned the fuselage-mounted engine, as arranged in the 121, seems to be normally accessible, since it is not buried in the structurally skinned part of the fuselage and its fairings can be hinged and/or be removable. A system of winches or hoists has been developed for removal and replacement of this engine and the estimated time required for a change, at a little over two hours, will not be appreciably longer than that for the two externally mounted engines.

Intake or duct losses have been calculated to be no more than 2% at take-off thrust and the position of the centre engine in relation to the tailplane and fin is such that turbine-disc failure will only be prospectively damaging within an ejection arc of 15°. The three engines are well apart from one another and mutual damage, in the case of failure or fire, will be unlikely or impossible.

The chance that a fuselage-mounted engine might enter the passenger compartment in a crash, or a heavy belly landing, had also to be considered. The answer to any question which might be asked by a passenger on this point is simple in spite of its somewnat grisly implications: the engine mountings are designed for 12 *g* accelerations; passenger-seats are normally designed for 9 *g* loads. The kind of accident which dislodges the engine is thus not likely to be survivable, and even after it has broken out of its mountings the engine will still have to pass through two fin spars, two other engine-mounting bulkheads and the pressure dome before it enters the cabin.

Centre-of-gravity problems appear to have been solved in the case of the 121 by the use of a powerful all-flying tailplane and no restrictions are visualized. With necessarily higher fuselage and unrelieved-wing structure-weights, the whole aircraft will probably weigh about 4% more than a podded variant, but this is balanced by the better maximum lift coefficient of the clean wing and uninterrupted flap area.

Incidentally, the 121 will not have slats or leading-edge flaps, but a full leading-edge droop with a movement of 30°. The gap on the upper surface as the edge droops will be closed by movable panels, leaving an aerodynamically smooth contour.



Air Transport . . . .

From Hares to Reindeer

by B. S. Shenstone F.R.Ae.S.

WITH the presently spreading Airline Culture, airports and what goes with them become more and more alike. There was the story of the tourist from a far country who, after emerging from his airliner, asked the date. On being told and referring to his diary he exclaimed with some surprise: "Jeez, this must be Helsinki!" A sad story.

But there is still some individualism, for if that tourist had flown north from Helsinki to Rovaniemi, on the Arctic Circle, he would have found the airport infested with reindeer instead of the hares one sees at London, Dublin and many other places. But apart from reindeer even Rovaniemi and the area around it looks more like Scottish Lowlands than the High North, what with farms and forests and rivers and 20,000 people in the very modern growing town. It is hard to realize that all of Finland's domestic airline routes operate north of the most northerly limit reached by B.E.A. in the Shetlands.

These Finnair domestic routes are booming and the airline is trying to keep up with the active rebuilding of the country and its new enterprises. In the U.K. the airlines tend to ignore communities as small as 20,000 persons, possibly because there are so many of them so close together. But they are far apart in Finland and road and rail travel take some time.

So with useful distances, a moderately booming community and a well-planned and carefully operated airline, air travel just jumps ahead. Finnair in size is comparable with Aer Lingus, having a staff of 1,200 and a fleet of six Convair Metropolitans and 10 DC-3s, in addition to the three Caravelles on order. Most of the domestic network is by DC-3, but, as in the U.K., this type is becoming too small but many of the runways are not long or strong enough for the Convair.

In 1959 a widespread programme of lengthening and strengthening runways was nearing completion so that not only will the Convair be able to use them but also to some extent the Caravelle, although it is not intended initially for domestic routes. For example: Kuopio in the middle of the country at the head of the largest lake system is having a 7,350-ft. runway with later extensions to 8,200 ft. and strong enough for the Caravelle. Rovaniemi is having 6,550 ft. for the Caravelle. Vaasa, half-way up the west coast, is having 5,900 ft., suitable for the Convair. Kajani, half-hour by DC-3 north of Kuopio, is extending to 6,550 ft., but only for the DC-3.

In addition a standard airport building has been developed, the latest version being at Rovaniemi as shown behind the reindeer in the illustration. On the left is the squat tower, beneath which are offices connected with airport administration. Then adjacent to the passenger lounge is the airline traffic and dispatch office. The passenger lounge is the full depth of the building and includes a very nice small restaurant and snack bar where the national drink of milk is much in evidence.

Passenger handling techniques are simple. Arriving by free coach at the airport building, the passengers get out but the baggage doesn't (although not because it has been accidentally left at the town terminal). The coach simply drives around the corner of the building, on to the tarmac (which may be gravel) and stops in front of the DC-3 where the baggage is loaded aboard, all in the front compartment.

In the case of an aircraft having just arrived, the incoming baggage is loaded on the coach at the same time. If a passenger is not using the coach, he identifies and picks up his bags before they are put aboard. Arriving passengers may either board the coach on the tarmac, or use the building. For a small operation like Rovaniemi there would be only one coach and the local Finnair representative travels out and back on it, with the departing and arriving passengers. This certainly minimizes staff numbers, but it means that arriving passengers have to wait until the aircraft has left before starting for town.

On Finnair DC-3s no meals are served and on domestic Convair routes (in 1959, only Helsinki-Oulu, 325 miles, and Helsinki-Vaasa) you are asked whether you wish to have food before the flight and pay a reasonable amount for it before boarding.

Passengers are not guided off or on aircraft. The stewardess assists at the aircraft steps (no airstairs) and takes the tickets during the flight which certainly simplifies ground problems. There are no boarding cards.

It is, as you see, a simple down-to-earth economically planned operation which assumes reasonably intelligent passengers and which is assisted by the relatively low density operation. More than that, it is one of the few scenic airlines left. Long may the DC-3 and other unpressurized aeroplanes last! What fun again to ride *below* the clouds. What does it matter if the bumps are a little more violent than above them? At least the marvellous Finnish forest and water landscape can be clearly seen and appreciated.

The rivers are being systematically brought under control for power but with elaborate means for ensuring the flow of logs downstream. I heard, however, that they have not had the hoped-for success with salmon "ladders" or equivalent means for getting them upstream around dams!

Finnair's overhaul and maintenance is done at Helsinki in a modern and extremely clean base. The hangar front is characterized by arched concrete structures from which the roof is suspended in the plane of the hangar doors. A large part of

Part of the large Finnair hangar at Helsinki, where its DC-3s, Convairs and—in due course—Caravelles are maintained. About 430 people are employed at the company's Helsinki base.

At Rovaniemi, in countryside compared by the author to that of the Scottish Lowlands, this herd of reindeer was undisturbed by the near proximity of such modern inventions as a DC-3 and a control tower

the building is covered with bright aluminium, a technique more widely used in Finland than in the U.K. The overhaul workshops are also clean, well kept and carefully organized. Even by Scandinavian standards the shops are extremely clean and some floors are even polished. The base staff is about 430.

Finnair, like Aer Lingus, another small international airline, is committed to jets although on a smaller scale, having no Atlantic ambitions. Doubling both the capacity and the speed in one step is a serious problem for any airline and particularly for a small one. It is fortunate that there is close technical collaboration between Finnair and S.A.S., so the impact of the Caravelle is being greatly reduced by the experience and knowledge of S.A.S. on the basis of a full season's operation. As might well be assumed from what is written above, Finnair is taking the jet problem very seriously and there is little doubt that they will show that jets are not just for big airlines but for airlines of any size who want to be, or must be, in the forefront of progress technically, operationally and commercially.

In spite of the fact that comparisons have to be odious to someone (or they wouldn't be worth making) it may be of interest to take the comparison of Finnair and Aer Lingus a little further on 1958 data. Aer Lingus had 2,000 employees as against Finnair's 1,200; they have 8,000 route miles against Finnair's 11,000. Aer Lingus carries 15% more people, flies 8½% more passenger-miles but only 1½% more revenue ton-miles. In spite of Finnair's much lower load factor it boasts the proud figure of 22,000 ton-miles per employee compared with the Aer Lingus figure of 13,400 and B.E.A.'s 15,000.

So do not let those reindeer worry you. I am sure they will be left north of the Arctic Circle—which is more than we can do with the London Airport hare. Finnair's face is turned south and west (back to the east) and within its scope will be as competitive as many a larger operator—which is certainly good for the larger operator and essential for Finnair.

The Air-freight Business

A RECENT application to the A.T.A.C. by B.K.S. Air Transport for a daily return all-freight service between Luton, Leeds/Bradford (optional) and Belfast is a reminder of the specialist non-scheduled services which have been operated by B.K.S. during the past 14 months in the regular shipping by air of Vauxhall cars from the factory at Luton to Northern Ireland.

This comparatively long vehicle-freight haul is an economically worth-while one for the manufacturers and consignees because of the reduction of insurance costs and in the saving of inevitable delivery wear, tear and damage when the vehicles have to be driven or transported several hundred miles and shipped and unshipped. When flown over, the cars do not suffer from the effects of sea-water-spray corrosion and the mileage involved is negligible. There is also a useful traffic in spares and in other freight—hence presumably, the fact that the application refers to the use of DC-3s and Ambassadors as well as of Bristol 170s. On the present non-scheduled operations vehicles and/or spares are flown over to Nutts Corner and contract cargo is normally flown back to Southend.

The place of air freight in the mind of the average shipper was well explained in last week's annual report number of the Air Market Review issued by James Burness (Travel), the brokers. After noting that the freight fixture/inquiry ratio (about five to 100) was lower than that for passenger business, the report went on to say that "charterers are always anxious to find out the conditions of air transport and what kind of rates can be offered. It is generally obvious that some of the inquiries . . . are not able to pay air transport rates even of the lowest order. . . .

"However, many charterers and forwarding agents are always looking for air transport opportunities which will compete with surface rates. Of course, it is sometimes possible to do this, but only for aircraft returning empty to their bases and for goods which would normally be shipped at *ad valorem* rates by sea." Later in the comment the writer noted that empty legs are quite unpredictable and generally come at such short notice that it is difficult to find suitable loads.

Work on the first of the three B.O.A.C. L-749s, which are being converted as freighters for Skyways, was recently completed. The principal modification is the fitting of a large upward-opening freight door (a Lockheed kit modification) into which the normal passenger door is inset.

Using conversion kits purchased from Lockheed some years ago, B.O.A.C. is fitting a large freight door—as shown here—to each of the three L-749A Constellations for use by Skyways on the Far East freight service.

Suction STOLs for Military Use

The Piper L-21 modified for high-lift boundary-layer research through distributed perforations or area suction type B.L.C. The wing has also been modified with a "droop snoot" to delay leading-edge stall. Vacuum cleaner brushing cleans out clogged wing perforations which might develop from dust or mud.

EXPERIMENTAL demonstration of boundary-layer control to delay stall by suction dates back to 1904 when Prof. Ludwig Prandtl used a small, slow-speed, hand-driven water channel in which he placed a cylinder having a lengthwise slot cut into the convex wall. A rubber hose led to the interior of the cylinder and, by cranking the water wheel to obtain a flow and syphoning on the hose, Prandtl was able to photograph the delay of separation shown by mica flakes on the water surface when the slot was rotated to a position on the downstream face of the cylinder. Through the years continued boundary-layer control experiments were carried out in Germany, France, England and the U.S. A leading British exponent of B.L.C. techniques is Dr. G. V. Lachmann of Handley Page.

In the United States, the Aerophysics Department of Mississippi State College under the direction of Dr. August Raspet has been carrying out a series of research experiments with full-scale aircraft utilizing area suction boundary-layer control. This is being done under Office of Naval Research/U.S. Army sponsorship. The aircraft include a Schweizer TG-3A sailplane, Piper L-21 and Cessna L-19, all modified. Now under construction is the Marvelette test-bed STOL aircraft, which will be used to flight-test the theories and components of the soon-to-be-built Marvel Army STOL.

The Schweizer TG-3A was modified in 1953 as a high-lift B.L.C. research vehicle. The wing was structurally reinforced to allow some 600,000 perforations to be drilled by bonding glass-fibre cloth to it, and experiments with sample specimens showed that the strengthened, perforated wing was approximately 10% stronger than the original configuration.

Two suction pumps were required for each wing inasmuch as the wings were divided into two compartments by the spars. The pump in the forward compartment was capable of operating at a high pressure differential in order to achieve the suction needed, while the rear pump was required to produce a lower pressure differential because of the lower surface velocities.

The sailplane has a wing area of 237 sq. ft. and an aspect ratio of 12.5. In its final modified configuration the sailplane was able to develop a lift coefficient of 2.28 with suction and stalled at 29.8 m.p.h.

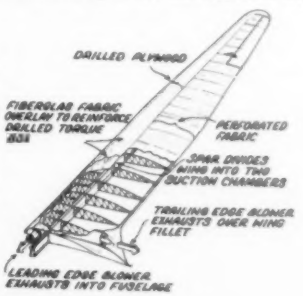
The principle guiding the modification of the Piper L-21 was to apply B.L.C. to the aircraft to test it in a take-off and minimum flying speed configuration; landing and cruise conditions being considered secondary. However, a number of modifications were made to the craft in order to test the concept thoroughly.

First, the wing-mounted fuel tanks were removed and a 10-gal. fuselage tank substituted and mounted aft of the rear seat. The wings were modified by the addition of riblets to support the upper fabric surface against suction pressure; it would otherwise be severely depressed by the blower suction resulting in an intolerable discontinuity in upper surface curvature behind the metal leading-edge skin. Provision was also made to bring suction air from the flap into the main part of the wing by means of a flexible fabric connection on the bottom and a metal seal plate on top and ends.

Rows of 0.030-in. perforations were punched in the wing from the 15% chord station (where the metal leading-edge ends) to the trailing-edge. A belt-driven blower was mounted above the engine with the exhaust air from the blower also used for engine cooling. Ducting from the wing was supplied by installing a double, transparent windshield with sufficient space between to conduct air to the blower, while a double cabin roof was used to connect wing roots with the double windshield.

A tricycle landing gear was decided upon for the B.L.C. L-21

This Schweizer TG-3A sailplane was the Aerophysics Department's first flight test aircraft to be used for high-lift B.L.C. research. Note suction pumps in wing near fuselage. There are some 600,000 holes in the wings, all hand drilled at a rate of about 1 per second.


DRILLED PLYWOOD
FIBERGLAS FABRIC OVERLAY TO REINFORCE DRILLED TORQUE BOX
PERFORATED FABRIC
SPAR DIVIDES WING INTO TWO SUCTION CHAMBERS
TRAILING EDGE BLOWER EXHAUSTS OVER WING FILLET
LEADING EDGE BLOWER EXHAUSTS INTO FUSELAGE

as the most suitable means of obtaining a large angle of attack for take-off. The main gear was a Cessna spring type with a welded bridge structure to carry the loads into the fuselage and a steerable nose gear with coil spring shock absorber was made and welded to the front bulkhead structure.

In order to obtain full rated engine r.p.m. with 6-7 b.h.p. taken by the blower, the propeller pitch was reduced. Strut braces were added at the leading-edge of the tailplane and linked with the trim screw in the fuselage in order to correct a severe vibration which appeared during low-flight B.L.C. speed.

The B.L.C. L-21 has a wing span of 35 ft., wing area of 178 sq. ft. and a gross weight of 1,350 lb. Powerplant is a 125 b.h.p. Lycoming. During tests against a Piper PA-18 the L-21 was able to obtain a 42% reduction in take-off distance over a 50-ft. obstacle when distributed suction B.L.C. was used. Also at a flow coefficient of 0.00605 a new stalling speed of 28 m.p.h. was accomplished. It can operate from less than 150-ft. runways with ease and fly at a true airspeed of 35 m.p.h. under complete control.

The Cessna L-19 has some 700,000 holes in its wing and is fitted with a camber-changing flap as well. Tail area has been increased and vertical plates added to improve rudder control. A pump attached to the generator pad and a 9-in.-dia. fan in each wing provide the area suction for B.L.C. At 2,300 lb. gross the B.L.C. L-19 stalls at 32 m.p.h. but still retains the cruising speed of the conventional Bird Dog. Approach speed is 36-38 m.p.h. and take-off under 150 ft. Both the L-21 and L-19 climb out at about a 45° angle.

A model of the Marvelette which will serve as a test-bed for the Marvel configuration. The Marvelette which is to fly by mid-1960 is intended to flight test the camber-changing wing, B.L.C. system and ducted propeller intended for use in the Marvel.

A model of the Mississippi State College Aerophysics Department's Marvel STOL for the U.S. Army. It features wrinkle-free moulded glass-fibre construction for low-drag, area suction-type boundary layer control, a ducted pusher propeller, a low-weight turboprop powerplant and a camber-changing wing.

Marvelette is the name given to a test-bed at present under construction. It features a high-positioned wing, tricycle landing gear and a ducted pusher propeller. Although it has a metal fuselage this craft will be used to test the glass-fibre camber-changing wing and glass-fibre propeller duct; the latter is equipped with flaps for pitch and yaw control. The 90-b.h.p. Continental powerplant will be installed in the fuselage under the wing.

The Marvelette has a design top speed of 200 m.p.h. and a landing speed of but 35 m.p.h. It will also have a wing B.L.C. exactly like that to be used on the final configuration known as the Marvel. The Marvelette is expected to fly by mid-1960.

The Marvel will be almost entirely of glass-fibre construction, with camber-changing wing and ducted pusher propeller. However, the powerplant will be the 125-lb. Allison T-63, which develops 250 s.h.p. It will be mounted on the tail in a nacelle, thus doing away with a long shafting to the propeller necessitated with a fuselage installation. B.L.C. will give the Marvel a landing speed of 35 m.p.h. and Dr. Raspet expects the craft to have a top speed of 350 m.p.h., and possibly up to 500 m.p.h. with the correct distribution of the area suction perforations.

Production of perforated surfaces has been made easier by the Aerophysics Department development of an automatic air turbine-driven drilling machine which spaces the holes 10 per inch and drills them at the rate of 5.2 per sec. in 0.032-in. aluminium alloy.—HOWARD LEVY.

A Sikorsky VTOL Airliner Project

AMONG the aircraft currently under study by Sikorsky Aircraft's VTOL advanced research group, is a convertiplane along similar lines to the Fairey Rotodyne. An artist's impression of this project—which is no more than an evaluation study at present—shows a large single rotor and a fixed wing carrying two turbine engines powering forward-flight propellers. The rotor presumably derives its power from these engines for the vertical phases of flight, and the aircraft appears to be the size of a 30-40-seater.

Another interesting project shown in the same drawing is a small military machine, perhaps intended for ground attack or target acquisition duties, with a turbojet for forward propulsion and a retractable two-blade rotor for the VTOL phase. Rotorcraft drones and a tilt-wing convertiplane are also shown among the types under study.

For the more immediate future, however, Sikorsky still favours the single-rotor helicopter concept which has been the basis of the company's past successes. A whole new range of turbine-powered helicopters is now being worked on, and the company has coined some new names for these vehicles. Thus, Sikorsky Turbocopters and Copterliners will be developed for passenger, mail and freight carrying while turbine-powered Skycranes will be offered as aerial prime movers, to be fitted with hoists, platforms, bins or pods to carry passengers, troops, freight or military supplies.

The first of the civil Turbocopters are the single-engined S-62 amphibian and the two- or three-engined S-61, both of which are on order for airline use later this year. Military Turbocopters include the U.S. Navy HSS-2 and the Marines HR3S-1, both variants of the S-61 design. First of the Skycranes will be the S-64, now under construction—a twin turbine development of the big S-60 flown last year, to carry an eight-ton payload. Four-engined Skycranes have already been projected, to carry 40-ton payloads.

Among the Sikorsky design studies shown in this impression is an airliner of similar configuration to the Fairey Rotodyne (lower left), and a military convertiplane with a retractable rotor.

From Trireme to Quadrijet

Background to Rome's New Fiumicino

by T. D. Calnan

NINETEEN hundred years ago the Roman Empire was facing the same basic transport problem as does the Italian Government today. Then, as now, the increase in the size of transports had outpaced the growth of base facilities. Then, as now, the same solution was found. The Romans built a new port; the Italians a new airport. The fascinating aspect of this comparison is that both the Roman port and the new Italian airport have been built on exactly the same site.

In the year 59 A.D. the Emperor Nero had just completed a new port, started and planned by his predecessor Claudius, after whom it was named. It was built to replace the old anchorage near the mouth of the Tiber at Ostia, where offloading facilities for the ships bringing food and merchandise to Rome from all parts of the Roman Empire were growing more and more inadequate. The new port provided a safe harbour and up-to-date port facilities for the biggest ships then in service (about 500 tons).

During the centuries, the silt carried down by the Tiber has extended the coastline seawards, so that the site of the old port of Claudius is now two miles inland.

Thus it is that Italy's most modern airport has come to be exactly superimposed on what was, in the first century, the most modern transport centre in the World. As the Comet 4s and Boeing 707s turn off the end of the main runway they will occupy the same point in space, within two vertical metres (the height of the new airport above sea level) as did the Roman triremes heading for port 1,900 years ago.

Even in its present incomplete state, Rome's new airport at Fiumicino is impressive. Work on the project is 75% complete and what is outstanding will be finished by June, 1960. This is the confident prediction of Ingegnere Giuseppe Rinaldi, of the Ministry of Public Works. On the visible evidence of the remarkable progress made in the past 20 months, under the energetic personal direction of Ing. Rinaldi, and given the very sharp spur of the Olympic Games in Rome next summer, there is no reason to doubt that this target will be achieved. But it may be a close finish.

"Aeroporto Intercontinentale di Roma-Fiumicino" is the official title of the new airport, with the emphasis on intercontinental. Rome's old airport at Ciampino does not qualify for the adjective, basically because its runway is too short. Fiumicino, on the other hand, will meet all the requirements of the latest jet airliners which, with maximum fuel load, will be able to take-off direct for their final destinations on the other side of the World.

The main runway (16/34) is 13,000-ft. long; the secondary runway (07/25) is 8,630-ft. long. Both runways are 200-ft. wide, with a further security strip, 50-ft. wide, on each side. The secondary runway is complete; 10,500 ft. of the main runway are ready and work is proceeding on the final 2,500 ft.

On the main runway, ILS, made by the Italian company F.A.C.E., is installed for the 160° approach. A German precision approach radar, made by Telefunken, will operate on both runways. A British Marconi surveillance radar, Type 264A, long-range, 50 cm., is being installed. In short, Fiumicino is planned to be as operationally efficient as the most modern equipment can make it.

The terminal building is on three floors. The lowest houses the central-heating plant, kitchens for the restaurants and the baggage-handling organization. The middle floor is devoted entirely to the handling of passengers. On the top floor are the airline companies' offices, restaurants and a garden.

The road leading to the air terminal passes the back of the building at the level of the middle floor, where passengers are deposited or collected. Thereafter, passengers' transport proceeds by another road to the lowest floor to collect or deliver luggage.

From the point of view of the passenger, there appears to be no fundamentally original thought in the design of the air terminal. The emphasis is on dealing with the maximum number of passenger-units with the minimum of effort, by preventing any possible deviation from the planned process of being Customed, documented, interrogated and asked to fill in forms. The indications are that the individual passenger will find this no less tedious at Fiumicino than it is at any other air terminal in the World.

From the two corners on the airfield side of the terminal building two long two-storey fingers extend into the aircraft parking area. These provide, on the top floor, a covered passage-way for passengers going to or from their aircraft. On the ground floor, offices and storerooms for servicing personnel are provided, as well as arrangements for transporting passengers' luggage to and from aircraft.

The frontage of the terminal building, together with its two out-jutting fingers, provide parking space, in close proximity to the air terminal, for 14 of the biggest aircraft in service. The total area of the whole parking apron is 480,000 sq. yards. Behind the terminal is a car park with a capacity for well over 2,000 vehicles.

Immediately to the east of the air terminal is the control tower, 175 ft. high. North and south of the control tower are, respectively, offices for the flying control organization and the administrative block of the airport. In the south-east corner of the airfield the first of a number of big hangars is nearly complete. It will house four of the biggest airliners in service and has floor dimensions of 775 by 170 ft. The domestic site to house the permanent military, police and Customs staff, consisting of barracks, church and dining halls, is already finished.

The total area covered by the airport is 10,100,000 sq. yards and the total cost of the whole project will be in the region of £15 million.

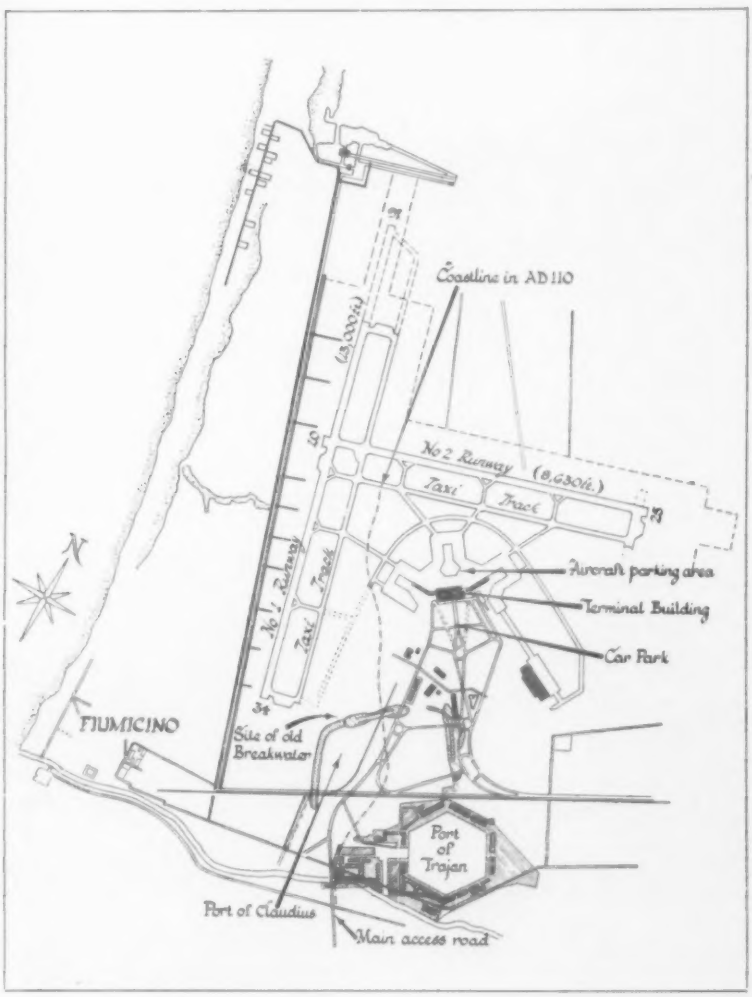
...icino Airport Development

Many problems connected with Fiumicino remain to be solved. The authorities whose task this is are the Ministry of Public Works and the Directorate-General of Civil Aviation, in the Ministry of Defence. Both these authorities, in seeking a solution to their problems, consult the experts concerned who, in most cases, are the commercial companies directly involved. For instance, the five big fuel companies, which will supply the needs of their airline customers at Fiumicino, have formed a separate company called SERAM (Shell, Esso, Rifaer—i.e., B.P.—Air Total, Mobiloil), for the express purpose of advising the authorities on fuel installations.

The refuelling organization at Fiumicino, while by no means

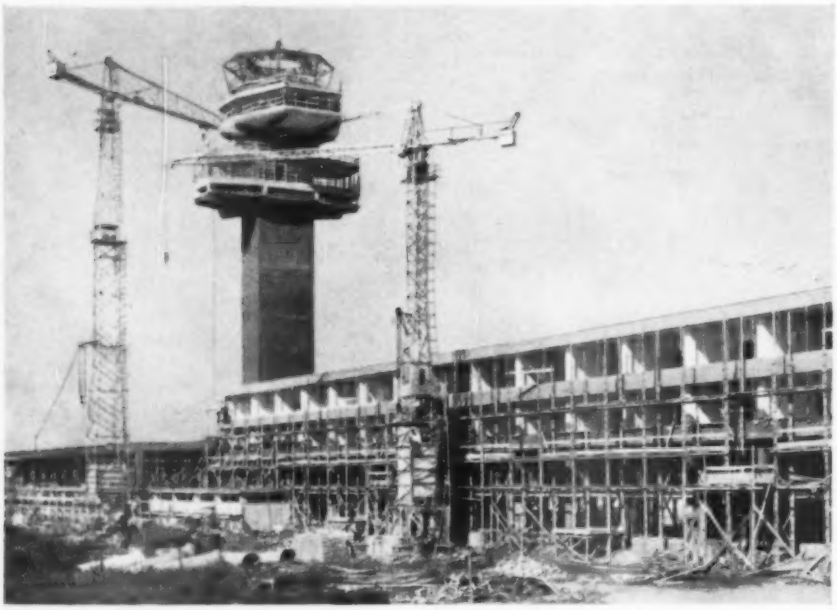
Here, from left to right foreground, Signor Togni, Minister of Public Works, Signor Gronchi, President of the Republic, and Ing. Rinaldi, superintendent-general of the Fiumicino project, inspect a model during a recent formal inspection of the airport.

The air-to-ground picture on the left should be compared with the sketch plan below. The photographs making up the mosaic were taken in October last year and show the runways and terminal complex. Part of the site of Trajan's Port can be seen at the foot of the picture.



The sketch plan on the right shows the airport layout, the site of the Roman ports and the coastline (dotted) as it was in A.D.110.

A realistic impression of the completed terminal building can be obtained (left) from a photograph of the model showing typical long-haul aircraft on their stands beside the fingers.



Work in progress on the control tower and administrative block at Fiumicino. The position of the tower in relation to the other features of the terminal can be seen in the plan-view photograph of a model at the foot of the page.

a new idea, merits description. At each of the 14 parking points adjacent to the air terminal and its two extending fingers, three types of fuel, J.P.4, A.T.K., 115/145 gasoline, as well as electric power, compressed air and water, will be, as it were, on tap.

The aircraft fuel will be piped under pressure from a satellite fuel installation on the edge of the parking apron. The satellite installation will, in turn, be supplied by fuel piped at low pressure from the main bulk installation, situated outside the airport boundary, close to the Fiumicino canal. The main bulk store will have a capacity of 1,320,000 gallons and the satellite 330,000 gallons. The fuel supplied to the main bulk installation by the five companies will go into the common storage tanks. Thus the customer taking his supplies from the pressure hydrant at the parking point will be getting SERAM mixture and not his favourite brand.

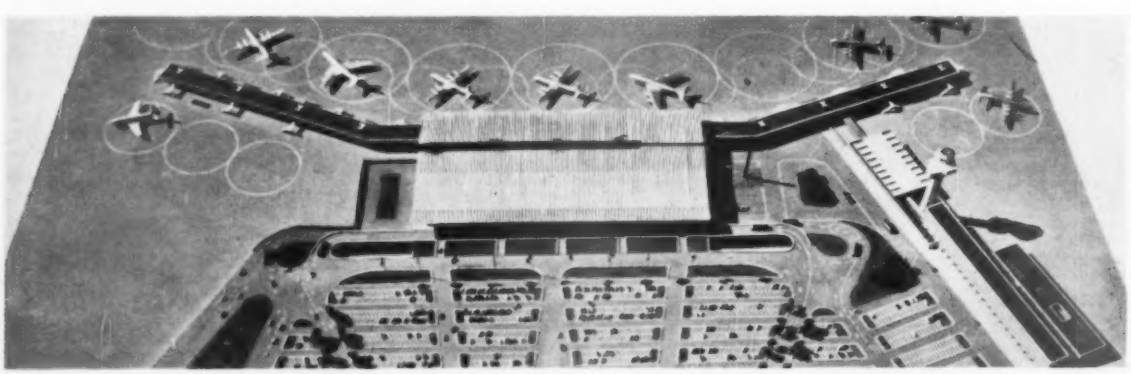
Although work is in progress on laying the complex network of underground pipes in the aircraft refuelling area, work has not yet started on either the satellite installation or the main bulk store. SERAM therefore foresee the possibility that, in the initial stages, both the supplying of the satellite storage and the actual refuelling of aircraft will have to be done by tanker. This means far too many tankers using the aircraft parking area.

The Airline Operators' Committee, whose chairman is Mr. William V. Sherwood of B.O.A.C., are another body who maintain the closest liaison with the two authorities concerned on a great variety of subjects ranging from air safety to passenger handling. It has been the duty of the Committee, for instance, to point out to the Directorate of Civil Aviation that the existence of an operational NATO fighter-bomber base at Pratica di Mare, some seven miles south of Fiumicino, constitutes a serious hazard. This is fully recognized by the authorities and various possible solutions are being studied. Although the final solution is not yet officially known, it is probable that the NATO squadrons will move elsewhere before Fiumicino opens.

There is little doubt that Fiumicino, when it settles down, will be a fine airport. But for some years to come it will have one great disadvantage—that of poor surface communications with Rome. Even with the new dual-carriageway road, which will, by the time the airport opens, connect the airport directly to the Rome-Ostia autostrada, it will take 45 minutes to complete the journey by coach. And that is a long time when you remember that the airborne time from Paris to Rome by Boeing 707 is only 105 minutes.

Various possible methods of improving the situation are being studied. One plan, being examined by the Ministry of Transport, is to connect Rome and Fiumicino by fast diesel or electric trains. But this involves a great number of technical difficulties which could not be overcome for some years. Another long-term project is to connect the airport by road to an autostrada, yet to be built, between Rome and Civita Vecchia. Another possibility is the use of helicopters—but Rome, as yet, has no heliports and has not sited any.

So, for the immediate future at least, passengers will have to put up with 45 minutes in the airport coach—not an attractive prospect at the height of an Italian summer.



This view of the airport model shows the layout plan of the terminal building and the arrangement of the two fingers. The car park, only a small part of which can be seen at the base of the picture, is large enough to accommodate more than 2,000 vehicles.

The Fighting Services

Flying Training Command Appointment

GROUP CAPTAIN J. C. POPE, C.B.E., formerly Senior Technical Staff Officer at No. 3 Group, Bomber Command, has now been appointed S.T.S.O., Flying Training Command, with the acting rank of Air Cdre. He was Senior Technical Officer at the Central Navigation and Control School, R.A.F. Shawbury, in 1954. He later commanded Nos. 30 and 24 Maintenance Units and went to No. 3 Group in 1957.

New Recruit Selection Centre

A SPECIAL youth selection centre has been opened at R.A.F. Cardington to interview and test Service candidates. This replaces the previous temporary 14-day selection boards which were held three times a year.

The permanent centre at Cardington will deal with approximately 200 candidates a week for 43 weeks of the year. In all it is expected that some 8,500 youths will attend the centre annually, of whom probably 50% will be accepted by the Service.

There are at present three apprentice schools—Locking (radio), Halton (aircraft) and Bircham Newton (administration)—and six boy entrant training establishments. Apprentice training lasts for three years and the boy entrant courses take 18 months.

An Appeal for Help

THE Commanding Officer of No. 9F (Islington) A.T.C. Squadron is appealing for help to overcome the two obstacles which are preventing the Squadron from achieving its objects of interesting youths in the Service and producing good citizens. These problems are the shortage of staff and the lack of sports and physical training equipment.

Officers, warrant officers and instructors are needed by the Squadron to train its 50 or so cadets and it is hoped that ex-R.A.F. personnel, especially officers and senior N.C.O.s, will answer the appeal and give up some of their spare time in helping the unit. Anyone able to assist in this field, or help in obtaining sports and P.T. equipment, is asked to contact the C.O. at the Squadron Headquarters, 65 Parkhurst Road, London, N.7.

Celebrating Middle East Service

AN informal party is planned to be held, on February 1, in a Hastings of No. 70 Squadron (Wg. Cdr. P. Ainley, D.F.C.) on a training flight over Cyprus. This celebration will mark the Squadron's fortieth year of uninterrupted operations in the Middle East.

On February 1, 1920, No. 70 Squadron—a fighter unit on the Western Front in the First World War—was re-formed at Heliopolis, near Cairo, as a bomber squadron. It found itself, however, mainly employed on transport duties, and was later redesignated "bomber-transport." In 1921 its aircraft escorted one of the car convoys which marked the desert air route from Cairo to Baghdad, and thereafter the Squadron, equipped with Vickers Vernons, flew mail on this route until it was taken over by Imperial Airways in 1927. From the end of December, 1928, until February, 1929, its Victorias played the leading part in the air lift of nearly 600 people who were evacuated from Kabul during inter-tribal disorders in Afghanistan.

At the outbreak of the Second World War, the Squadron was still a bomber-transport unit, but in 1940 it re-equipped with Wellingtons for purely bombing operations. No. 70 Squadron advanced with the land forces and in December, 1943, moved to Foggia, Italy, where it remained until the end of the War.

In 1948 it reverted to the transport rôle, and has since played a major part in Middle East operations, including those in Suez, Oman and Jordan. The Squadron received its Standard in 1955.

R.A.F. Appointments

THE following are among recent Royal Air Force appointments:—

Air Ministry: Wg. Cdr. E. H. B. Martin, M.Sc., and Sqn. Ldr. R. B. Davidson, D.F.C. (with the acting rank of Wg. Cdr.) to the Department of the Chief of the Air Staff.

Fighter Command: Wg. Cdr. R. L. Smith, O.B.E., to R.A.F. West Raynham to command.

Coastal Command: Gp. Capt. J. Goodman as Command Signals Officer; Wg. Cdr. B. Lewin, D.F.C., to Gibraltar to command No. 224 Squadron.

Flying Training Command: Wg. Cdr. T. A. Trotter to Headquarters for staff duties.

Technical Training Command: Wg. Cdr. T. Balmforth, D.S.O., D.F.C., A.F.C., to No. 1 Radio School, R.A.F. Locking, to command No. 1 Wing; Wg. Cdr. F. H. O'Neill to No. 3 School of Technical Training, R.A.F. Hereford, to command the catering wing; Sqn. Off. J. M. Higgins, R.R.C., P.M.R.A.F.N.S., to R.A.F. Halton as Senior Matron, with the acting rank of Wg. Off.

Maintenance Command: Wg. Cdr. R. A. Watts, A.F.C., to R.A.F. Farnborough for duties with the Experimental Flying Department; Sqn. Ldr. W. J. Laidler to R.A.F. Farnborough to the Empire Test Pilots' School as Chief Instructor, with the acting rank of Wg. Cdr.

Signals Command: Wg. Cdr. E. D. Smith, B.Sc., to R.A.F. Henlow to command the Radio Engineering Unit, with the acting rank of Gp. Capt.; Wg. Cdr. L. M. Courtenay to R.A.F. Medmenham to command the Radio Introduction Unit; Sqn. Ldr. B. H. Goodger to the Inspectorate of Radio Services, for staff duties, with the acting rank of Wg. Cdr.

Middle East Air Force: Wg. Off. V. M. Ashworth, R.R.C., P.M.R.A.F.N.S., to Headquarters as Principal Matron, with the acting rank of Gp. Off.

British Forces Arabian Peninsula: Gp. Capt. L. J. Joel, D.F.C., to R.A.F. Eastleigh to command; Wg. Cdr. G. P. Howell, O.B.E., to No. 114 Maintenance Unit, Aden, to command; Sqn. Ldr. F. M. Hegarty, A.F.C., to Headquarters for air staff duties, with the acting rank of Wg. Cdr.

R.A.F. Germany: Wg. Cdr. W. E. Colahan, D.F.C., to R.A.F. Laarbruch to command the flying wing.

Other Appointments: Wg. Cdr. H. A. England, D.F.C., to Germany for duties with NATO; Wg. Cdr. C. S. Hawley, M.B.E., to the Ministry of Defence for duties with the British Joint Communications and Electronics Board.

More Service News

No. 38 Group Reunion.—The 14th annual general meeting and reunion dinner of the No. 38 Group Old Comrades Association will be held at the Victoria Hotel, Buckingham Palace Road, London, on March 12. Tickets, price £1 each, are available from Mrs. L. C. Randall, Hotel Metropole, Brighton, Sussex.

Regiment Shoot.—The Lloyd's Cup for small-arms proficiency, presented by the Committee of Lloyd's in 1943 for annual competition by R.A.F. Regiment Squadrons, has been won by No. 16 (Field) Squadron (Sqn. Ldr. P. A. Brewer) based at Felixstowe. The 1958 winners, No. 1 (Field) Squadron based at El Adem, were runners-up, but won the Harris Cup (the M.E.A.F. rifle-shooting trophy) and the Higginson Trophy for all-round efficiency which is competed for annually by R.A.F. Regiment units in the U.K., Middle East and Germany in rotation.

SOUTH COAST DEFENDERS.—R.A.F. West Malling is the only operational Fighter Command base south of the Thames. This pair of Javelin FAW.6s belongs to No. 85 Squadron (Wg. Cdr. G. A. Martin, D.F.C., A.F.C.), which returned to the station last August.

Astronautics and Missiles

Symposium on Space Research

Opening session of the first International Space Science Symposium at the Centre Universitaire Méditerranéen, in Nice, on January 11. Speaking is the Cospar president elect, Prof. H. C. van der Hulst, Professor of Astronomy at Leyden University, Netherlands.

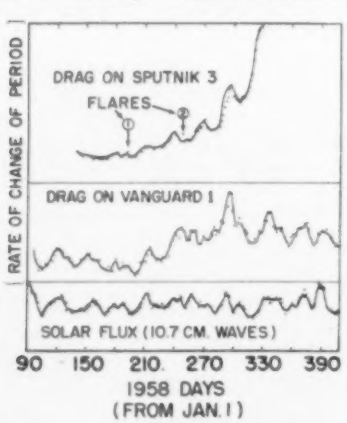
ALTHOUGH the Earth's radiation belts were perhaps the favourite topic at the first International Space Science Symposium, held in Nice from January 11-15, the door was, in fact, wide open to all comers for the exchange of information on a wide variety of subjects related to space research. Organized by the International Committee on Space Research (Cospar), the Symposium brought no fewer than 90 contributions from scientists of many nations, and it was pleasing to note that the meeting was supported by some 40 scientists from the United Kingdom with 11 papers.

The programme was divided into seven sections: the Earth's atmosphere; the ionosphere; tracking and telemetry; cosmic radiation and interplanetary gas; solar radiation—aurora and air-glow; the Moon and the planets; and meteorites and interplanetary dust.

Business sessions of the Cospar group were arranged to coincide with the Symposium; their outcome was briefly reported in our issues of January 15 and 22. The Royal Society, representing the British National Committee on Space Research, presented a report on "Space Research Activities in the United Kingdom During 1959," which surveyed the work of the various university departments concerned in the upper atmosphere research programme and the prospects for the future.

The main contributions in the U.K., the report emphasized, fall into four main categories:—

(1) Upper atmosphere research with rockets; (2) optical and radio tracking of satellites and space probes; (3) activities of the Satellite Prediction Service and World Data Centre "C"; and (4) the design of scientific instruments for use in satellites, and design studies of methods whereby British rockets could be used to launch Earth satellites.



Solar effect on satellite drag (Jastrow).

Centralizing Information

The World Data Centre for rockets and satellites established at the Radio Research Station at Slough, in October, 1958, the report continues, is fulfilling its intended purpose of collecting data on space research and exchanging it with the other two centres in Washington and Moscow. The flow of data is still relatively small and consists mainly of satellite positional observations, though reduced radio observations tables of orbital elements and ephemerides of certain satellites are also being received.

The Centre houses a large number of published and unpublished reports, many of which contain the results of investigations with rockets and satellites. Two catalogues of the material in the Centre have now been issued.

Of the prediction service, the work of providing times and direction of transit of satellites passing within radio range of observers in the British Isles has been continued. Predictions have been issued regularly for Sputnik III and Explorer VI, Explorer VII when transmitting and for Atlas (1958 Zeta), Discoverer V and Discoverer VI when visible from this region. Predictions were also issued from time to time on Explorer IV and Explorer VI after their transmitters had ceased to function. More than 100 establishments and observers received the predictions at weekly intervals.

Skylark Soundings

As might have been expected, most of the British contributions to the Symposium concerned work with the Skylark high-altitude rocket. Little information could be elicited on the subject of the forthcoming U.K./U.S. co-operative satellite project using the Chance Vought Scout.

"Measurement and Control of Rocket Attitude" was the subject of a paper by Mr. J. J. Gait. In many sounding rocket experiments, he said, it was necessary to have knowledge of the attitude of the rocket-borne sounding equipment. Additionally, or alternatively, there may be a need for controlling the attitude of the equipment.

The author reviewed work directed towards measuring and controlling the attitude of the Skylark, which had been carried out for the Ministry of Supply (now Aviation) at the R.A.E. In the field of attitude measurement, this covered work on magnetometers, sun sensing photocells, microwave interferometry and photography. In the control field, the emphasis

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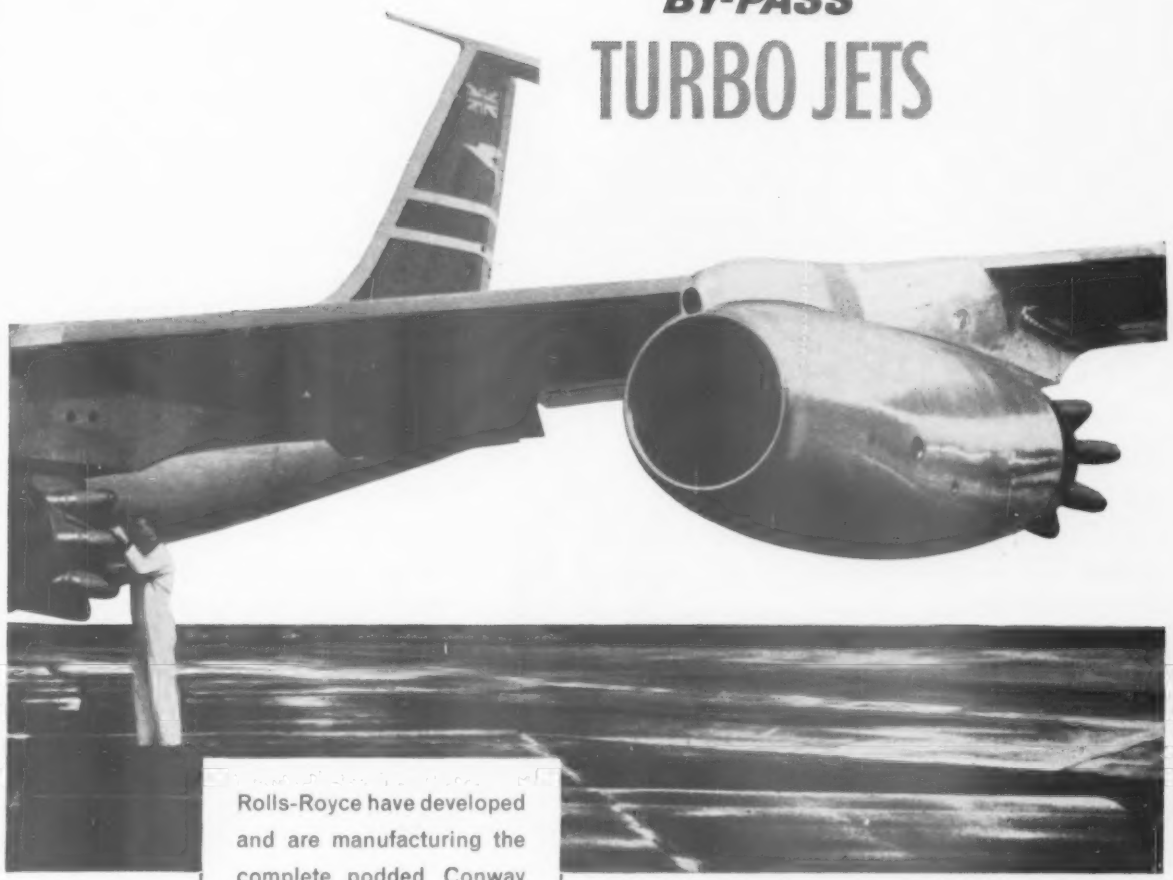
ROLLS-ROYCE
CONWAY
BY-PASS
TURBO JETS



Rolls-Royce have developed and are manufacturing the complete podded Conway installation, including the thrust reverser and silencer, for the Boeing 707-420.

CONWAYS HAVE BEEN ORDERED TO POWER THE BOEING 707-420's OF—

Air India International
British Overseas Airways Corporation
Lufthansa · Varig of Brazil

THE DOUGLAS DC-8's OF—

Alitalia · Canadian Pacific Airlines
Trans Canada Air Lines

AND THE VICKERS VC. 10's OF—

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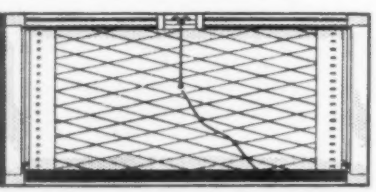
working pilot

The IFALPA delegate speaking to the ICAO Special Meeting, Montreal, February 1959

I should like to describe what we have been able to do using Radar for departures. Four aircraft taxi out at the same time. They are fully loaded, it is a hot night so they have an immediate problem. After take-off Departure Control wants immediate contact so we give them a call. Number 2 aircraft takes off two minutes later, and receives the same clearance until he picks up Radar Departure, who say " Turn left heading 050° "—now this is into inbound traffic, which means he will require continuous attention from Control to make sure he picks his way safely through the incoming traffic. Aircraft number 3, two minutes later, same as before, except when he picks up Radar Control, The Controller says " hold 4,000 ft. heading 130°," (he has vectored him off so as to clear the way for aircraft number 4). Aircraft number 4 receives the same departure, but he is told to hold 3,000 ft., and the Radar Controller's attention will also be especially directed towards him because he is bucking the flow of traffic in a place where he does not properly belong.

With regard to the overall achievement, we have now vectored four aircraft into a single airway. Only one of them has achieved the altitude he wanted, and unfortunately he will have to come down through the altitude of the others. Radar is a marvellous device, and it has solved many of our problems, but it is *not* a navigational aid. An area coverage system would not solve every problem, but it would provide the capability of outbound tracks that would take us immediately out of the area from whence discrete tracks could be drawn giving lateral separation of a safe order. This is a problem which is incidental to the use of single track airways, and we feel **it can be solved by lateral separation which should be made available through pictorial presentation coupled with area coverage.**

THE DECCA NAVIGATOR



THE NAVIGATION SYSTEM FOR THE JET AGE

THE DECCA NAVIGATOR COMPANY LIMITED LONDON

(*Continued from page 140*)

was on the use of simple fixed-nozzle jets of air or hot gases.

Details of sodium vapour experiments carried out with Skylark were given by J. A. Rees, The Queen's University of Belfast (Department of Applied Mathematics), in a paper entitled: "Sodium Vapour Trails as a Method of Determining Upper Atmosphere Temperatures and Winds." The experiments were undertaken with the object of studying: (a) the variation of temperature with height between altitudes of 60 and 150 km., and (b) the magnitude and direction of the prevalent winds.

The temperature measurements were obtained by photographing the sodium trail through a Fabry-Perot interferometer and by measuring the widths of the sodium D line fringes produced. Information concerning upper atmosphere winds was obtained from a series of simultaneous photographs of the trail and star backgrounds taken from three widely separated camera positions. The lecturer also described two techniques of analysing the wind data, a mechanical-optical method and an alternative computer method.

"Wind and Temperature Results Obtained in Skylark Experiments" was the subject of a paper by G. V. Groves, prepared on behalf of University College, London, Imperial College, and The Queen's University of Belfast. Results were given of the first two "grenade-window" experiments carried out at Woomera on November 13, 1957, and April 17, 1958; mention was also made of the first sodium experiment conducted on December 3, 1958.

Winds in the middle stratosphere were from the east in the November firing and from the west and stronger in the April firing. The maximum temperature occurred at 50 km. altitude and was slightly less in the April firing. A grenade explosion at 130 km. resulted in a conspicuously glowing cloud, 2 km. in diameter, which persisted for several minutes.

In the sodium experiment, wind speeds were determined from 95 to 120 km. altitude.

Radiation Belts

Taking as his theme, "Geophysical Effects of the Trapped Particle Layer," Dr. Robert Jastrow, of the Theoretical Division, Goddard Space Flight Center (N.A.S.A.), stressed that one of the most significant results of the I.G.Y. rocket and satellite programmes was the evidence indicating that atmospheric properties in the auroral zone were influenced by the intensity of particles in the outer Van Allen radiation belt.

Dr. Jastrow pointed out that the drag fluctuations experienced by artificial satellites were largest when the perigee of the orbit was on the sunlit side of the Earth. When the perigee was in darkness, he said, the fluctuations became smaller or disappeared. On the other hand, the fluctuations which accompanied solar flares or magnetic storms seemed definitely to be of corpuscular origin.

L. G. Jacchia had suggested in 1959 that the fluctuations had a tendency to repeat every 27 days, which was the period of rotation of the Sun about its axis. Thus it appeared that in addition to the heating and expansion of the atmosphere produced by steady solar exposure, there was further heating caused by streams coming from definite spots on the surface of the Sun, which came around every 27 days in the course of its rotation.

The increase in drag acting on Sputnik III had been tentatively identified, Dr. Jastrow said, with the arrival of corpuscular streams in the vicinity of the Earth. Jacchia's results showed that the drag increase on Sputnik III, observed at the time of a major solar flare, did not occur simultaneously with the flare, but began approximately one day later, at the same time that the magnetic K index spurted upward. (A rise in the K index signified the onset of a magnetic storm, and therefore the arrival in the auroral region of the relatively slow-moving solar corpuscular stream which accompanied the flare.)

Jacchia had refined his calculations to the point where he could say that ultraviolet radiation was probably the cause of the recurrent drag variations which followed the course of the 10-cm. solar flux.

The particles in the Van Allen belt, Dr. Jastrow continued, might provide the explanation for the difference between atmospheric densities measured at White Sands and Fort Churchill. The Van Allen particles were trapped by the geomagnetic field in orbits in which they spiralled along the lines of magnetic force.

The particles in the outer belt were funnelled into the arctic and antarctic zones by the concentration of the magnetic field near the north and south poles. The outer belt dipped down into the atmosphere in these regions and disturbed the normal conditions which existed at lower latitudes. Interaction between the trapped particles and the atmosphere could produce distinct geophysical effects.

First, the temperature of the auroral zone would be raised by the energy transferred in collisions between the atoms and molecules of the upper atmosphere and the trapped particles in the outer belt. Secondly, the auroral borealis and the auroral australis might result from the exitation of the arctic and antarctic atmospheres by these same collisions with the particles trapped in the outer zone, the lecturer concluded.

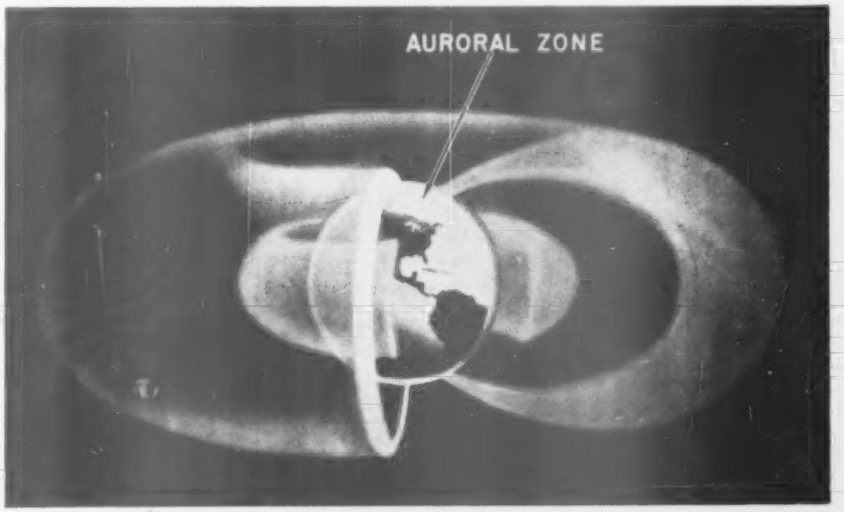
Russian Results

A paper by S. N. Vernov and A. E. Chudakov (U.S.S.R. Academy of Sciences, Moscow) dealt with "Terrestrial Corpuscular Radiation and Cosmic Rays." Their conclusion, verified by Russian and American experiments with satellites and probes, was that the total energy of high-energy particles in space was similar to the energy of the magnetic field and to the kinetic energy of the atoms. For this reason, the properties of cosmic space were determined by processes of energy transfer to high-energy particles and back again.

During several orbital passes of Sputnik II (from November 3 to 9, 1957), an anomalous increase in the number of particles was observed to the north of 60° geographical latitude. An especially large increase was observed on November 7, 1957.

Subsequently, with Sputnik III (from May 15 to August 15, 1958), it was found that in each case—and without exception for more than 300 observations—X-rays with energies of 10^5 eV were present at high latitudes (60° N.). A comparison of data obtained at various altitudes showed that the intensity increased along the lines of force of the magnetic field, thus providing experimental proof of the existence of particles trapped by the Earth's magnetic field.

During the flight of Lunik I, the maximum intensity was observed at a distance of 26,000 km. from the Earth's centre. Lunik II recorded the maximum intensity at 17,000 km. along



Distribution of the radiation belts (Jastrow).

the magnetic force line of 59° N., although in this case the intensity was greater.

A contribution by four Soviet scientists, L. V. Kurnosova, V. I. Logachev, L. A. Rasorenov, and M. I. Fradkin, concerning "Cosmic Ray Investigations by the Second Cosmic Rocket Landed on the Moon," gave the information that at a distance of 10,000-30,000 km. from the Earth's centre, there was an appreciable increase in the counting rate of instruments intended to detect α particles. It was difficult, they said, to interpret this result, but there was a possibility that these energetic particles were accumulated on belts girdling the Earth.

More information on the lunar experiment concerned in Lunik II was given in the paper, "Radiation Measurements During the Flight of the Second Soviet Cosmic Rocket," by S. N. Vernov, A. E. Chudakov, P. V. Vakulov, Yu. I. Logachev, and A. G. Nikolayev. Apparatus contained in Lunik II included instruments to gain new data on the outer radiation belt, to detect cosmic radiation between Earth and Moon, and also to search for a lunar radiation belt, if such existed.

With respect to the outer radiation belt, the trajectories of Lunik I and Lunik II differed only slightly; the second probe passed through the zone of high intensity some 200-300 km. closer to the plane of the geomagnetic equator than the first rocket. This shift in the trajectory, it was explained, could not have been responsible for the altered shape and displacement of the intensity-against-height curve maximum; it only emphasized this difference.

The approach to the Moon, at a distance of 1,000 km. from the lunar surface, did not reveal any increase in the intensity of radiation within 10% of the cosmic background. It was difficult to obtain accurate data over the range 0-1,000 km. from the lunar surface because of the short flight time over this part of the trajectory; but certainly there was no large increase in intensity detected.

U.S. Experiments

Much attention to the problem of the radiation belts was also given by American physicists, who described the findings of the Explorer satellites and Pioneer probes. A paper by A. Rosen, T. A. Farley, and C. P. Sonett, stated that the instruments of Pioneer IV, launched in March, 1959, showed a very marked increase over the Pioneer III results in the radiation comprising the outer zone, without a corresponding increase in the inner zone. This suggested a solar origin of soft particles to populate the outer zone.

A programme was now under way to reduce all the available data concerned with fluctuations of the radiation flux in the outer Van Allen zone, and the data showing variations in the slow count rate outside the zones of trapped radiation.

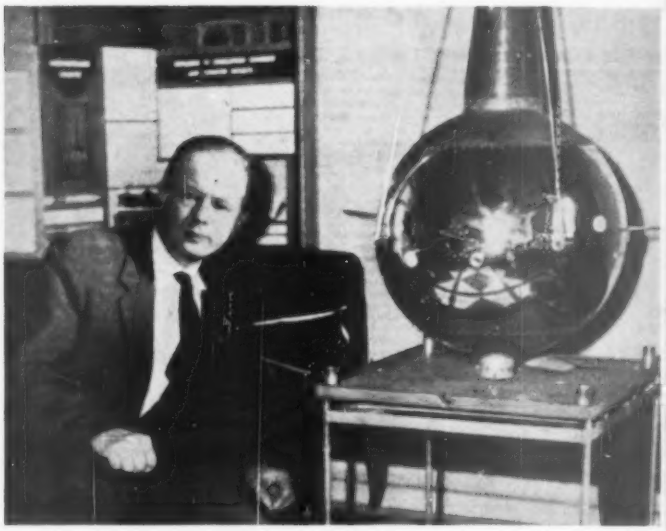
Lunar Photography

One of the 12 Soviet papers of more general interest was by Prof. A. A. Blaganravov, leader of the Russian delegation, who spoke on "Photographs of the reverse side of the Moon taken from the interplanetary automatic station of the third cosmic rocket." This contained some further details of the method of orientation employed in securing the celebrated pictures of the Moon's hidden face.

Technically, the orientation was achieved by means of optical and gyroscopic gauges, said the Professor, to which the initial switch-on command was transmitted at the moment when the station was at a distance of slightly more than 60,000 km. from the Moon and was situated between the Moon and the Sun. The gauges, situated on the upper hemisphere, ensured that this end of the probe was turned away from the direction of the solar rays, while those on the lower hemisphere sought to establish the longitudinal axis in the direction of the Sun.

The signals of the gauges were introduced into a small logical computer. This worked out the optimum programme (that requiring the minimum expenditure of energy) from the commands, regulating the discharge of neutral gas from the small nozzles, two pairs of which made the station spin round its longitudinal axis, while each of the other two pairs turned it round one of the two transverse axes.

In this manner, the regular rotation of the station stopped for a certain interval of time, and the station turned its lower end to the Sun. After the appointed time of "damping down" the station's motion had passed (when the optical device at the opposite end was in the shade), a command was given to open the lids which covered the windows in the upper half. Behind these windows, a system of sensitive "lunar" optical gauges was situated.



Prof. H. C. van der Hulst poses beside a full-scale model of the American satellite Vanguard III, which successfully entered orbit on September 18 last year.

At the same time, the solar gauges at the opposite end were switched off. At this moment, the direction of the probe's longitudinal axis was at an angle of 13° to the Moon. It was at this stage that the "lunar" gauges went into operation.

The signal indicating the presence of the Moon coming from the optical device served as a command for the automatic photographic device to begin working. This moved the film, took charge of the alternating duration of the exposure in five stages, and worked the shutters of the two photographic lenses with different angles of vision. The focal lengths of the lenses were 200 and 500 mm. with relative apertures 1:5.6 and 1:9.5 respectively.

Forty minutes after photography began, the camera system was switched off automatically, and automatic treatment of the film was started.

In this way, a large collection of photographs of varying quality was obtained. The image of the lunar disc was fully covered in the picture taken by the first lens, while the second produced an image of part of the lunar surface on a large scale.

The film was protected against the effects of cosmic rays. Developed and fixed by automatic processes, the film was wound up in a special case for storage and later transmission of the pictures to Earth. Transmission began when a command signal from Earth switched on the feeding mechanism aboard the probe, which moved the film and switched on the television apparatus and the transmitters.

Exobiological Research

This necessarily brief review of the Cospar Symposium cannot be allowed to close without mention of the paper by Joshua Lederberg of Stanford University School of Medicine (Department of Genetics), on the subject of "Exobiology—A New Experimental Science."

"The cosmic distribution of life," said the lecturer, "cannot fail to excite the interest of all inquisitive minds." His problem was to discover more exact details on the chemistry and physics of planetary surfaces and atmospheres so that future probe vehicles could be properly and economically designed for specific tasks.

There were immense opportunities opening up in the field of biological investigations beyond the Earth and these could concern such questions as the rôle of genes in embryological development, protein synthesis, the biology of viruses, and the evolution of species.

In his imaginative paper, Lederberg dealt with the possibility of landing an instrumented probe on the surface of Mars. He considered in particular the opportunities that would arise for micro-biology if a microscope-device could be let down on to the surface as a primary detector. Linked with a television camera, it was possible that images of microbes in a small

(*Continued on page 143*)

WINDSCHUTZSCHEIBEN

WINDSCREENS

PARABRISAS

TUULILASIT

VINDRUTOR

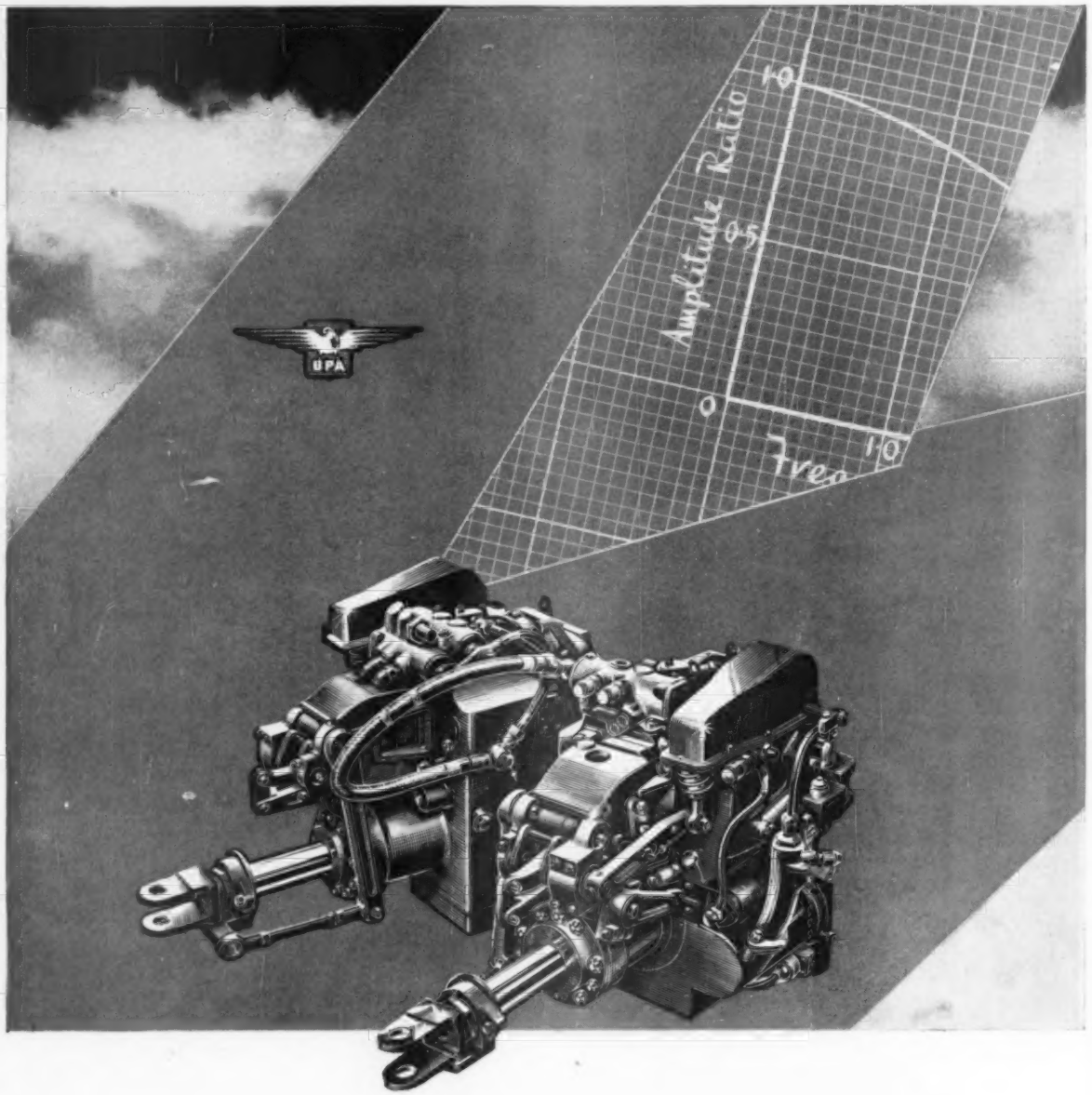
PARE-BRISE

VOORRUITEN

PARABREZZA

by "TripleX"

1 ALBEMARLE ST., LONDON W.1.



POWER CONTROLS

The rudder of the Avro Vulcan B. Mk. 2 aircraft is operated by the dual powered flying control unit shown in the illustration. The individual units are self-contained and independent of each other. Automatic and instantaneous change over from the main to the auxiliary unit takes place in the event of a main unit failure.

BOULTON PAUL AIRCRAFT LTD.
WOLVERHAMPTON, ENGLAND

P.C.27

(*Continued from page 142*)

sample of the Martian surface—if such exists—could be transmitted back to Earth, in much the same way as the Russians had scanned pictures of the Moon.

Barring extreme heat or chemical poisons, Lederberg pointed out, there was probably no drop of natural water or pinch of soil from the Earth's surface that would not yield abundant microscopic evidence of life on *this* planet.

Automatic collecting devices for feeding suitable samples to the microscope were currently under study, but if more complex devices were considered impractical, it was the lecturer's opinion that dust particles in the Martian atmosphere would suffice. Larger samples, he said, would allow for the concentration of living cells from mineral particles by differential flotation in dense liquids. A travelling ribbon of transparent tape would slowly carry particles past the aperture of the microscope. This might take the form of a fixed focus instrument, with a pre-calibrated entry slit at the object plane, unless a simple servo system for optical focusing became feasible.

Needless to say, it will be a long time before an experiment of this kind becomes possible, if only in the provision of the appropriate "soft-landing" probe, but if the present trend towards automation in space-research continues, there will soon be no logical reason for men to remove their fragile bodies to the surfaces of alien worlds.

Russia's New Rocket

SPECULATION on the nature of the multi-stage rockets the Russians are firing into the Pacific Ocean continues. It is made difficult by the fact that there is still no reliable evidence of the payload they are designed to carry.

According to *Tass*, the first rocket in the launching programme was fired on January 20 for the purpose of "producing a more powerful ballistic multi-stage rocket for orbiting heavy Earth satellites and for realizing space flight towards the planets of the Solar System."

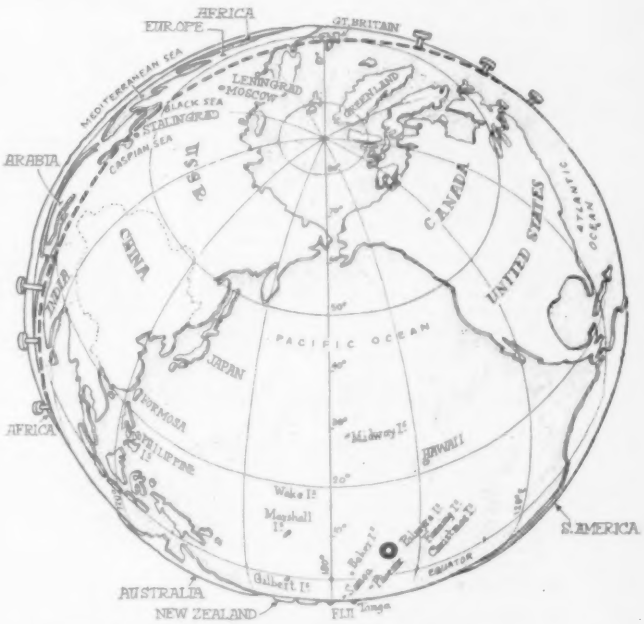
The accompanying map indicates the range of the Russian rocket and the disposition of possible launching sites within the U.S.S.R. One of the suggested points of departure is Kapustin Yar, an area some 60 miles east of Stalingrad.

The agency said the rocket was launched 7,760 miles from the target area, reached a maximum speed of 16,000 m.p.h., and deposited a re-entry body only 1.25 miles from the appointed target centre. It was reported that the second stage broke up in the atmosphere at a height of between 50 and 56 miles. The re-entry body was described as a "marker" for the purpose of trials which, in actual space experiments, would be replaced by an active third stage.

Not only would the test-firing, if as successful as claimed, provide a convincing demonstration of ballistic marksmanship—surpassing even that of the Atlas over a greater distance—but it would indicate that practically the whole World is now within striking range of Soviet rockets.

As a space-booster, the most conservative estimates suggest that it may be capable of putting four to five tons into orbit while one American authority has spoken in terms of 10 tons. If, in fact, the payload is of this magnitude, the possibility of adapting the vehicle for launching boost-gliders in the Dyna-Soar class can scarcely have been overlooked by Soviet designers nor, presumably, the prospect of developing a "long-playing" military satellite vehicle which could be launched with a thermo-nuclear warhead and maintained in space during times of international stress.

This would be more of a psychological weapon than the conventional ICBM. It could, nevertheless, explain Mr. Khrushchev's recent statement that a fantastic new weapon was "in the hatching stage."



This map shows the range of the Russian "space-booster" launched 7,760 miles into the central Pacific on Jan. 20. The impact area is indicated by the black ring, and the heavy dotted line drawn across Russia indicates the limits of possible launching sites, a strong possibility being Kapustin Yar, near Stalingrad. The line has been extended to show the enormous area that this new rocket can cover, from a given point.

Met. Flights by Unmanned Miniatures

RUSSIAN meteorologists, according to the Swiss *Aero Revue*, are giving up their radio-sonde balloons and sending radio-controlled miniature aircraft into the upper atmosphere to carry their recording instruments. One object, it is stated, is to get exact cloud heights, and probably another advantage is that miniatures can be made to level off at certain specified heights, in the manner of man-carrying meteorological aeroplanes, and thus secure more accurate data than the continually ascending balloons. It is not stated whether these so-called model aircraft will be guided back to base with their load of instruments. They must be pretty big, and well worth recovering.—A.E.S.

Space Research in Italy

FIRST launching in Italy's space research programme is expected to occur next July at the new launching site at Perdas de Fogu in Sadinia. This was recently announced by Professor Luigi Broglio, president of Italy's National Commission for the Study of Space Research. The initial programme will consist of a maximum of 10 launchings, but no other indication is available of the overall scope of the programme or what funds have been allocated to it by the Italian Government.

The field of research will lie between 150 and 1,250 miles altitude. The launching vehicles will be Italian, American or a combination. For altitudes up to 150 miles, a two-stage, solid-propellent rocket of wholly Italian design and manufacture will be used. For launchings to altitudes above 500 miles it is planned to use U.S. rockets, including components of the Chance-Vought Scout. Nose cones of all rockets, it is reported, will be Italian made and designed. Nothing has been published regarding payloads, nor is there any information regarding the precise aims of the research programme. There are indications, however, that the Italians are particularly interested in exploring the problems of re-entry and recovery.

French Instruments in Russian Satellites

REPORTS suggesting that the Soviet Union had "promised to provide a rocket for the launching of a French satellite" have drawn a comment from Prof. A. A. Blagonravov, who led the Soviet delegation at the recent International Space Science Symposium, organized by Cospar. The statement was not quite true, the Professor said.

When a French scientist raised the question of the possibility of conducting scientific experiments with the help of Soviet rockets, the Soviet delegation had replied:

"The range of interests of Soviet space explorers is very great, therefore, their requirements should naturally receive top priority. Nevertheless, if any scientific institution in France should submit a proposal concerning an important scientific problem and the method of solving it with the help of developed techniques, an official application should be sent to the U.S.S.R. Academy of Sciences which will consider a specific proposal and may approve it, depending on its significance and technical aspect."

(*Continued from page 129*)

ENGINEERING ACTIVITY.—The Society of Automotive Engineers has set up an Engineering Activity Board, to develop, collect and make available technical information of interest to its 25,000 members. Mr. J. T. Dyment, chief engineer of T.C.A., has been appointed to represent air transportation on this Board.

IFALPA MEETING.—The 15th Conference of the International Federation of Air Line Pilots Association is to be held at Istanbul March 22 to 29.

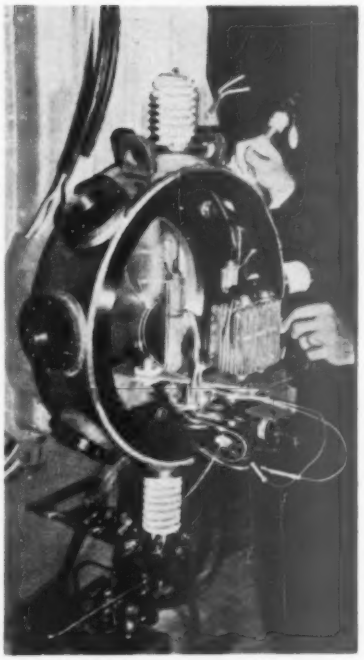
B.C.A.R. REVISION.—A new issue (number 4) of "Section L—Licensing" in the "British Civil Airworthiness Requirements" has just been published by the Air Registration Board. Six revised notices to Licensed Aircraft Engineers and to Owners of Civil Aircraft (including a contents list) have also been issued.

MARINERS GROUNDED.—Following a series of fatal accidents to Martin-Mariner flying-boats of the Royal Netherlands Navy, the Dutch Minister of Defence has decided to ground the remaining aircraft. A decision on their replacement is awaited; in the meantime, R.N.A.F. Dakotas equipped for transport, search and rescue are shortly to be flown to Netherlands New Guinea.

RUSSIAN LECTURER.—Prof. Alla Masevich, vice-president of the Astronomical Council of the U.S.S.R. Academy of Sciences, is to speak before a meeting of the British Interplanetary Society on February 10 on "Soviet Space Research." Venue is the Hoare Memorial Hall, Church House, Westminster, S.W.1, at 19.00 hrs.

MORE CANADIAN DOPPLER.—Following news of an order for Canadian Marconi Doppler equipment from Irish Air Lines (THE AEROPLANE AND ASTRONAUTICS, January 22) comes news of a similar order from Varig, the South American airline, for CMA-623 equipment for its Boeing 707s.

MOD-KIT HELICOPTERS.—Operators of Hiller 12E helicopters will soon be able to buy conversion kits to: (a) uprate the Lycoming powerplant from 305 b.h.p. to 340 b.h.p.; (b) turbo-supercharge the engine to increase the hover ceiling; or (c) replace the three-seat cabin with a four-seat version.



MICRO-G.—A low-thrust rocket engine which obtains propulsion from a stream of ions (charged particles) created by bringing together cesium, in liquid form, and tungsten. It has already run for more than 50 hr. at NASA's Lewis Electric Propulsion Laboratory.

Commercial Aviation Affairs

FERRY TO DUBLIN.—B.K.S. Air Transport will start its vehicle ferry service between Liverpool and Dublin on April 25, at an initial frequency of one service a day, increasing to four a day in the summer. Fares will be £11 single for an 11-ft. car, and £4 14s. single for passengers.

DC-8 CERTIFICATION.—The second version of the Douglas DC-8, powered by 15,800-lb.s.t. Pratt & Whitney JT4A-3 engines, has now been certificated by the F.A.A. Deliveries are to begin at once to Eastern, United and National Airlines.

BACK TO MADEIRA.—In the news story under this heading in the issue of January 15 (pp. 63-64) we omitted to mention Silver City—who have also applied for renewed U.K.-Madeira service rights when the Porto Santo airport is completed. Apart from the effects of any "spheres of influence" which may be assigned under a second "new deal" for the independents, Silver City were the first to apply for approval for landplane services and are the natural family successors to Aquila Airways, whose flying-boat services terminated in September, 1958. If the application is approved, Silver City plan to use Hermes on the service.

M.E.A. RESULT.—In 1959, Middle East Airlines increased its revenue by 26% over the 1958 level. The number of passengers increased by 42% to nearly 150,000. The airline expects to show "a satisfactory profit" for 1959 according to the chairman and managing director.

AIDING EGYPT.—A civil aviation assistance group has been established in Cairo by the U.S. State Department's International Co-operation Administration. A five-man F.A.A. team will work with United Arab Republic technicians to plan, design, procure and install equipment for an airways system. The programme will include a radar approach control facility at Cairo International, as well as installation and modernization of ILS, ALS, VOR and communications equipment.

AUSTRIAN VISCOUNTS.—Agreement has been reached, according to reports from Vienna, between Austrian Airlines (AUA) and Vickers for the sale to Austria of six Viscount 837s. The contract is expected to be signed within the next few weeks. All six Viscounts, which will be similar to the Continental Airlines 812s, will be supplied from the Vickers "stockpile" in March and April. The order brings the total of Viscounts sold to 415.

THAI PROGRAMME.—Mr. Hans Erik Hansen, former S.A.S. general sales manager, has been appointed executive manager of Thai Airways International. Lieut. Cdr. Prasong Suchiva is general manager and Air Chief Marshal Chalermkiat Watanangura is chairman of the board. Thai will start operations in April, 1960, with Douglas DC-6Bs, and plans to operate a daily service between Bangkok and Hong Kong; three services a week on the routes Bangkok-Rangoon-Calcutta, Bangkok-Tokyo and Bangkok-Singapore (two stopping at Kuala Lumpur); and two services a week on the Bangkok-Phnom Penh-Saigon route.

BOEING 720 TESTS.—More than 40 hours of flight testing have been completed by the two Boeing 720 test aircraft, which will be joined by a third in March. Take-offs and landings up to max. gross weights have been made and stalls, control characteristics and flutter investigated. Speeds of up to Mach 0.95 have been reached.

WELCOME FREIGHT.—Silver City Airways recently provided a Channel airlift from Ferryfield for an urgently needed consignment of whisky to be taken on to Paris by the company's Roadair cargo service.

RUSSIAN HELICOPTER ROUTES.—During 1960, more than 100 passenger helicopter routes covering a total distance of more than 6,200 miles will be opened in Russia, according to Moscow Radio. Services will be started in the Caucasus, Central Asia, Siberia, the northern regions and the Far East.

BRITANNIA FOR LEASE.—Listed in the latest Market Report of the Aircraft Exchange is an offer to lease a Britannia 318, at $65,000 per month. The Britannia is the version supplied to Cubana, which has four with mixed first-class/tourist interiors.

CHICAGO HELICOPTERS. — Two more S-58s have been ordered by Chicago Helicopter Airways, which has six of this type already. The company is planning for an increase of more than 40% in its passenger traffic in 1960, and will introduce turbine-powered S-61s in 1961.

IL-18 TO CAIRO.—An Aeroflot Il-18 flew from Moscow to Cairo non-stop last week in 7 hr. 27 min. on a proving flight. The existing Aeroflot service calls at Tirana in Albania.

ALLISON CONVAIR.—First flight of the Super Convair conversion with Allison 501-D13 engines was due this month, with certification scheduled for March. Nearly 80% of the F.A.A. performance evaluation testing has been completed with the YC-131C, and the engines have been approved for use in the Convair at an initial overhaul period of 1,000 hr. Lake Central Airlines is reported to be a prospective customer for the Super Convair; 11 conversions have already been ordered by corporate owners.

INCREASING FREQUENCIES.—Qantas will increase the frequency of its jet services on the Pacific to five a week on March 6. Two of these services from Sydney will go on to London, one to Vancouver and two terminate at San Francisco. Three jet services a week will be flown on the Kangaroo route through India to London.

EAST AFRICAN RESULT.—In 1959, East African Airways increased its passenger traffic by 11%; there were 26.7% more passengers on international services and 6.6% more on domestic services, for a total of 130,402. Cargo was up by 10.7%, about three-quarters of the total being on domestic services. Revenue passenger-miles went up by 28.5% and load ton-miles by 29.4%.

GERMAN AIRPORT CONFERENCE.—The German Airports' Association (ADV) is to hold its annual conference this year at Bremen, on May 23-24.

CONTRACT SIGNED.—Mr. H. Sammons, managing director of Napiers (left), and Mr. L. O. Barnes, president of Allegheny Airlines (right), signing the contract for Eland conversions for Allegheny's Convairs.

NICOSIA TERMINAL.—A new air terminal is to be built at Nicosia Airport, Cyprus. The cost, about £500,000, will be met by Britain.

News About People

LEAVING SHORTS.—Mr. T. W. (Tom) Brooke-Smith, chief test pilot for Short Brothers and Harland, Ltd., is resigning from the company later this year. Before leaving, he will pilot the SC.1 VTOL research aircraft through its final transition tests at R.A.E. Bedford. He was appointed chief test pilot after completing the 1947-8 course at E.T.P.S.

AN M.o.A. RETIREMENT.—Mr. V. H. Wilton, O.B.E., Assistant Director of Aircraft Production, retired from the Ministry of Aviation on January 16. He served in the R.F.C. during the First World War and afterwards joined Instone Air Lines as a ground engineer, later transferring to Imperial Airways. He joined the A.I.D. in the late 'twenties and went to the Production Directorate after the Second World War.

BLACKBURN CEREMONY.—Mr. A. Jopling addresses Blackburn apprentices during their 29th annual prize distribution on January 18. On his right is Mr. H. J. Stieger, designer of the pre-war Monospar aeroplane and now Sheriff of Hull.

HONOURED.—Mr. E. T. Jones, Deputy Controller (Overseas Affairs), Ministry of Aviation, and a Past President of the Royal Aeronautical Society, has been awarded Honorary Fellowship of the Institute of the Aeronautical Sciences. He was to receive his scroll at the Institute's Honors Night Dinner in New York on January 26.

A FERRANTI APPOINTMENT.—Mr. W. D. H. Gregson, D.F.H., A.M.I.E.E. former London manager of Ferranti, Ltd., has been appointed as assistant general manager of the company's Scottish Group. The Edinburgh and Dundee factories of the Group develop and manufacture weapon systems, radar and specialized electronic equipment.

AWARD WINNER.—David Hyde, a research assistant in the Department of Flight at the College of Aeronautics, Cranfield, has won the 1959 John de Havilland Award. The value of the Award is £400 and he plans to use this money to finance a tour of three continents—Africa, North and South America—to study airline operation in primitive and isolated areas.

ROLLS-ROYCE RETIREMENT.—Mr. W. P. Calvert, director and general manager of Rolls-Royce of Australia, retired on January 2. He served his apprenticeship at the Royal Aircraft Factory, and joined the R.F.C. and R.A.F. in the First World War. He had been with Rolls-Royce since 1937 and subsequently became manager of the Aero Service Department.

B.O.A.C. DIRECTION.—Mr. Gilbert H. Lee has been appointed commercial director of B.O.A.C. He first joined Imperial Airways as an accountant in 1930, and has most recently been chief commercial manager of B.O.A.C.

B.O.A.C. POST.—Mr. M. D. (Tim) Morrissey has been appointed B.O.A.C. general sales manager and will be responsible for co-ordinating the Corporation's sales policy. Mr. Morrissey has been sales manager, U.K. and Europe, since 1951.

EAGLE APPOINTMENT.—Mr. F. A. Burden, M.P. for Gillingham, has joined the board of Eagle Overseas Airways, Ltd.—a company formed in December, 1957, to function as a development and study organization for the Eagle group.

A LANCASHIRE CHANGE.—Mr. E. W. Percival has resigned from the board of Lancashire Aircraft Co., Ltd., and is now no longer connected with the company or the Prospector aircraft; he ceased to be technically concerned with this aircraft some time ago.

SPOTTER RESULTS.—Results of the 1960 Aircraft Recognition Society's Championships were: HURRICANE TROPHY for best team: Air Britain "A" (J. M. Gradidge, L. N. Long, R. J. Croxon); 2nd, R.O.C. 2/Q3 Wallington Post. BRITANNIA TROPHY for best individual: Obs. M. J. Hooks, 34 points. BLOODHOUND TROPHY for best Services team: Royal Netherlands Air Force (Lt. J. G. Valette, Sgt. B. C. Jonge, Sgt. J. Van der Woude). HERACLES TROPHY for best junior team: Bournemouth School C.C.F. (Peter Ford, Michael Jones, David Pascall). FOKKER TROPHY for best Service individual: Lt. J. G. Valette. AIR PICTORIAL TROPHY for best A.T.C. individual: Cadet Cpl. D. C. Donovan, 42F Sqn., King's Lynn.

Personal Flying

ONCE again, it seems from the Popular Press, the light aeroplane millenium is upon us. In starting its air test series (by its motoring correspondent), the *Sunday Express* is "looking ahead to the not-too-distant day when the family plane will join the family car."

While handing this lively newspaper a bouquet for its laudable attempt to popularize aviation, we feel bound to point out that we have heard this story before. There was a time, some of us may recall, when according to at least one well-known daily newspaper, the Flying Flea was going to be in everyone's garage, but, fortunately for their enthusiastic drivers, few Fleas flew before the design was banned. To be fair, it was not only Fleet Street that was over-enthusiastic; if we recollect aright, so was the Air League of the day.

As the first *Sunday Express* air test was of the eminently practical Jodel two-seater, there is no fear of history repeating itself in that respect. The whole article, however, in the mood set by its sub-title, "it's so easy," by lightheartedly dismissing all the difficulties with which personal flying is confronted in this country, is likely in the long run to do more harm than good to the movement.

When the author says, rather lyrically, "Out of the mists of January, I flew up into a sky that was clear and bright with sun. Down below I could see the winter, but all round me was the spring," aeronautical readers will not need to be reminded that the author is still learning to fly.

When he gets round to returning to winter, for landing, he may find that the January mists have obscured the airfield, and that the radio has more use than for saying "Roger out or anything else you happen to pick up from the films."

We are as anxious as anyone to boost personal flying. But this cannot be achieved by ignoring the bleak realities of the British climate. In all fairness, it must be pointed out to the amateur pilot that, far from forgetting British Railways and the crowded roads, he cannot expect to get any real use out of a light aeroplane for the best part of the winter.

• • •

Even with the comprehensively equipped American types now arriving in this country, amateur pilots cannot enter controlled air space under instrument conditions without a valid instrument rating. As there is no separate rating examination for private or commercial pilots, the amateur must achieve virtually professional standards in all the obscure subjects associated with the instrument test.

COUPÉ.—With new sliding hood, spats and brakes, this Rollason Turbulent is seen at Redhill.

At the moment, there is nothing to stop the P.P.L. holder from launching off into instrument weather, so long as he stays out of controlled air space, with or without the necessary equipment and as a potential menace to himself and everyone else. Many amateur pilots, however, who are well qualified from the flying point of view and have the equipment, would like to get a rating and are prepared to fit into the general control pattern.

But suppose they submit to the M.o.A. rating test. Theoretically, they may take it in their own aircraft, assuming it is equipped for the comprehensive and even archaic procedures on which they will be examined. As the examiner must be in charge of the aircraft, however, he must have the type on his commercial licence, and this essential preliminary almost immediately prohibits the test from being taken.

The alternative is for the amateur to take the examination in the Ministry Doves. Apart from the fact that it appears almost traditional for even very experienced commercial pilots to fail on some part of their initial rating examination, the amateur's unfamiliarity with the Dove will almost guarantee a failure. Several attempts are likely to be necessary for the full rating to be granted, with appropriate expense in hiring the Dove for two, three or more hours, at £20 or so an hour.

For pilots whose responsibilities include large numbers of passengers, the rating tests are obviously no more stringent than they should be. For the P.P.L. holder, however, a less complex rating scheme, with appropriate safeguards, and perhaps on the lines of the R.A.F. instrument card system, should surely be devised.

Gliding Notes

by Dr. A. E. Slater

HERE is an extract from *The Sailplane and Glider* of April 14, 1933. It is the final paragraph of an editorial article on the first aeroplane flights over Mount Everest, which had been made 11 days before. It reads:—

"Incidentally, when is somebody going to soar over Mount Everest? Doubtless a special design of sailplane would be needed, and there might be political difficulties in gaining access to a suitable launching spot, but we are convinced that it could be done. What is more, if the wind suddenly failed, the pilot could glide a hundred miles to safety."

Well, I was right about the "political difficulties," but wrong about the "special design of sailplane." Dr. Brennig James, who is also convinced it can be done, had his first application to the Nepalese Government refused; but now that permission has come, he will doubtless take a sailplane of standard design.

When that paragraph was written, the World's gliding record for height was only 8,320 ft., and nobody had beaten it for four years; but now it has been shown that up to 44,250 ft. you don't need a "special design," though above that height you would want a sealed cabin to keep your blood liquid, and a larger wing area would be of advantage.

As to gliding 100 miles from 29,002 ft. in still air, laminar flow has now doubled that distance. Pilots at the international contest of 1948 in Switzerland found that, if upcurrents became scarce among the high peaks, they could be pretty sure of reaching the head of a valley, and could then glide down it at a descending angle little different from that of the valley floor. And, anyway, Doc. James and his party intend to keep their landing ground within gliding distance throughout their flights.

• • •

Correspondence in THE AEROPLANE in early 1953 revealed that some of the members of the 1933 expedition were a bit touchy about the downcurrent which pushed them down 2,000 ft. in a few seconds as they approached Everest. One even stated that it was found on the windward side of the mountain and was actually expected there.

After considering the accounts and the topography again, I have come to the conclusion that the downcurrent was not in the lee of Everest peak, because photographs show the "ice plume" to stream away from it almost horizontally for a long distance, as if the wind blows round the peak rather than over it. The downcurrent must have been in the lee of either Lhotse (then called South Peak, being two miles S. of Everest) or the South Col, which separates it from Everest, because the aeroplane was pushed down almost on to Lhotse.

They then recovered height, evidently by crossing the South Col into the West Cwm, up which a strong west wind was blowing. One occupant of the aeroplane, writing afterwards of this height recovery, characteristically thought of only one possible explanation: "However, the alarm was short-lived, for our splendid engine took us up through the great overfall."

Some years later, a Spitfire pilot flew past Everest from east to west over the South Col, against a strong west wind. He seems not to have noticed any downcurrent on the approach, but on crossing the Col he was violently lifted by a tremendous upsurge, and afterwards looked round to see Everest far below. He, at least, knew what lifted him.

• • •

A FINAL report on the "Wave Safari" held at the Long Mynd and Shawbury after Christmas shows a total soaring time for six flying days of 95 hours all but five minutes. Army, R.A.F., Surrey, Avro and Midland Clubs took part with eight machines in all.

Correspondence

Where is the Concession?

I READ in a recent copy of THE AEROPLANE AND ASTRONAUTICS that the Government have said that they are assisting private and club flying by granting landing concessions at certain State aerodromes and by offering reduced housing and parking charges.

This may be true in some cases, but since Croydon Airport closed, our flying club has moved to Biggin Hill and our experience has been just the opposite.

Landing fees have been increased from free landings to approximately £35 per year per aircraft. Aircraft hangarage for club aircraft has increased as follows:—

	CROYDON	BIGGIN HILL
Tiger Moth ...	£78 2 0	£117 3 0
Auster	£91 6 0	£144 0 0
Gemini	£89 2 0	£180 0 0

The figures for private aircraft show an even greater increase in costs.

I fail to see any assistance in these figures and meanwhile, Croydon is rapidly becoming derelict and costing the country even more money than when it was in use.

Biggin Hill, Kent. J. A. LONGMOOR, Vendair Flying Club.

News of 99 Squadron

MAY I, through the courtesy of your columns, appeal to readers who may have served with No. 99 (Royal Air Force) Squadron. I am re-writing the history of No. 99 Squadron and will appreciate any information and photographs—any such material will of course be returned if requested.

The Squadron, which is in Transport Command, is based at R.A.F. Lyneham, Chippenham, Wilts, and operates Britannia aircraft. Those of your readers who are able to supply information should communicate with the Adjutant of No. 99 Squadron.

Chippenham, Wilts. D. NURSAW (Flt. Lt., R.A.F.).

Why Not the Pegasus?

I HAVE been following with interest the news in the daily and technical Press regarding the Army's requirement for a single-engined aircraft and was surprised to read that the Beaver was to be ordered in preference to the proposed British Pegasus aircraft, particularly in view of the fact that the Beaver must have reached the limit of its development, whereas a new type would be capable of development over many years to come.

The Government's decision is the more surprising as it is reliably reported that the United States Army will be putting the Beaver aircraft on the surplus market in 1960. If this is the case why is the Government purchasing aircraft which the United States Government consider obsolete?

If the Government had gone ahead with the development of the Pegasus, this aircraft might conceivably have been used by Western Armed Services as a replacement for the Beaver.

North Cheam. "PERPLEXED TAXPAYER."

"Fluid Dynamic Drag"

WITH reference to your review (January 8, p. 51) of Hoerner's "Fluid Dynamic Drag," the implication in the final paragraph may cause unnecessary inconvenience to prospective buyers.

Bailey Bros. and Swinfen, Ltd., who were agents for the first edition in this country, maintain a limited stock of the second at £7 10s. Their address is: Hyde House, West Central Street, London, W.C.1.

London, W.1. F. H. SMITH (Librarian, R.Ae.S.).

First to Bootstrap?

YOUR article, "High Energy Rocket Propulsion" (January 8 last), referring to the Pratt & Whitney XLR-115 engine, suggests that this engine is the first to use a "bootstrap" cycle, in which some of the propellent after having driven the pumps, is injected into the combustion chamber and not exhausted directly overboard.

I should like to point out that the Spectre variable-thrust rocket engine for which my company is responsible has always used a similar method. Hydrogen peroxide, after being used for cooling, is decomposed to drive the turbine, the exhaust from which then enters the combustion chamber, as in the XLR-115. While the idea is not claimed as original, it is fair to say that the Spectre was the first engine in which it was incorporated and made to work, a fact which should not completely escape notice.

I should also like to point out that the particular process is not, strictly speaking, "bootstrapping," which in rocket parlance merely means that the engine runs as a self-contained unit, using its own propellents in one way or another to drive its pumps. In actual fact, both the XLR-115 engine and the Spectre use a "topping" turbine or more descriptively a "low loss" turbine, the implication being that none of the propellent is used up without producing useful thrust in the combustion chamber.

Edgware, Middx. W. N. NEAT (Rocket Division, de Havilland Engine Co., Ltd.).

Groundabout

Wreview of Wre-grouping. As I get it, Hawker Siddeley, who are lined up with Blackburn's—or is it Folland?—are amalgamating with D.H.'s who are or were associated with Saunders-Roe who are tied up with Westland who, I believe, have an eye on Bristol Helicopters or maybe it's Fairey Helicopters. Of course, Fairey's are working with D.H. and Hunting, and Bristol and, I hear, Hunting are grouping with—er, is it Vickers *and* English Electric or Vickers *or* English Electric? Then there's Rolls-Siddeley, and Handley-Royce and Bristol-Page and Boulton-Palvis and Scottish Austeration—boy! bring me a large brandy amalgamated with two aspirins in association with one coffee, strong, black. . . .

*

This seems to be the place to tell you of the unconfirmed rumour that Sir Roy Dobson is having printed a quantity of standard letters beginning: "Dear Sir(s), May I have the pleasure of your company . . ."

*

A to C. I foresee some maddening confusion between the Britannia and the Britannic when the latter enters service. Remember the War-time story about, I think, a Desert Air Force squadron who sent a signal to U.K. asking for a dozen airscrews and got a dozen aircrews? And the even older confusion between hangars, airship, and hangers, coat?

*

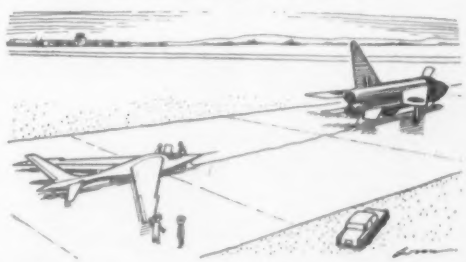
"As I get it, the payload on that leg will amount to little more than a verbal message from the pilot."

*

Contrived Pertinence? "The Air Writers' Trophy consists of a hand-carved mahogany representation of a Spitfire propeller blade with quill attachment."—From an *Air Britain* leaflet.

*

"When I write to the Ministry I work on the principle of 'If you can't convince 'em, confuse 'em.'"



"Well, I suppose somebody had to have a go at it..."

*

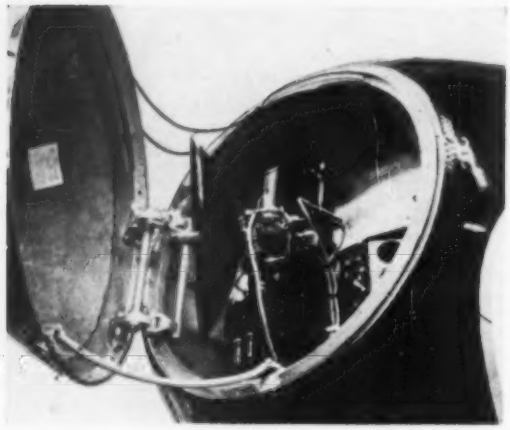
Note of Genuine Relief. Thos. Cook and Sons announce U.S.S.R. tours "with guaranteed departures for English-speaking people."

*

What—no margins? The year's primest remark so far: "The trouble with the Comet is that it's overpowered."

by Gnome

NOTES AND EVENTS



WARNING RADAR.—The nose installation of the scanner unit of the Ekco Type E 160 airborne weather radar in a D.H. Comet 4. B.O.A.C. Britannia and Comet fleets are equipped with Ekco weather radar (including the new South American Service—see "The Aeroplane and Astronautics" for January 22), which the Corporation has also selected for its Boeing 707s.

R.A.F. CRASH TENDERS.—The Pyrene Co., Ltd., has recently received a Ministry of Aviation contract for 25 airfield crash tenders to give fire protection service on R.A.F. airfields. This tender has an Alvis Salamander chassis and a 240-b.h.p. Rolls-Royce petrol engine. Its total foam output is over 5,000 g.p.m. for more than 2 min. Pyrene Mark 4 airfield crash tenders are already in service with the R.A.F., the R.C.A.F. and the R. Ceylon A.F.

METAL CUTTING.—British Oxygen Gases, Ltd., who have undertaken development work in the United Kingdom in connection with the tungsten arc cutting process, are now marketing the equipment by arrangement with Union Carbide, Ltd. This process was originally developed by the Linde Co., of the Union Carbide Corporation for form-cutting readily oxydized metals, such as aluminium, stainless steel, titanium and copper.

A.E.I. IN 1959.—Aircraft and radar equipment are among the components described in the 1959 A.E.I. (Rugby), Ltd., review of progress. The company is manufacturing the AC electrical power system and equipment for the D.H. 121 and has built a new aircraft systems laboratory at Coventry for development testing. New brushless alternators are also being developed for the D.H. 121. A.E.I. is producing advanced ground-to-air missile guidance radars and tactical control radars which will supersede Sting-Ray. A broadband telemetering system has been developed and adopted for ballistic and guided weapon development work.

RADAR HEAD.—The aerial array for the Cossor C.R. 787 10cm. surveillance radar mentioned on this page.

BELGRADE CONTROL.—Cossor C.R.787 10 cm. surveillance radar has been ordered for the new international airport which the Yugoslav Government is building at Belgrade. The contract covers duplicate radar transmitters of the latest type, together with four display consoles. Two of the displays will be used for general air traffic control, a third will be used for approach control and the fourth will be used as a monitor.

INCREASED PRODUCTION. — A new automatic plant has been put into operation at the Ferranti electronics factory at Oldham for producing the company's ZS30 series diodes. These small diodes are used in aircraft power supply systems, guided missiles and radar installations.

Company Notices

NEW COMPANIES

Enstone Enterprises, Ltd. (645,781).—Private co. Reg. December 30. Cap. £1,000 in £1 shs. Objects: To acquire and develop an aerodrome at Enstone, etc. Directors: Horace W. Mole, Sheisley, Fernhill Heath; Edgar T. Mole, 37 Oldnall Road, Kidderminster. Sec.: H. W. Mole. Reg. office: 12 Church Street, Kidderminster.

Warwickshire Aero Club, Ltd. (646,020).—Private co. Reg. December 31. Cap. £250 in 200 shs. of £1 and 100 shs. of 10s. Directors: Neville H. Birch, Lockington Hall, Derby; Barry H. Birch, 6 Paradise Lane, Hall Green, Birmingham; Arthur J. Penzer, 66 Park Hill, Moseley, Birmingham. Sols.: G. F. Pearson, Rowe and Co., Birmingham.

CHANGE OF NAME

Metal Wall Tiles, Ltd. (314,814), 62 New Broad Street, E.C.2.—Name changed to C. E. Harper Aircraft Co., Ltd., on September 3, 1959.

New Patents

APPLICATIONS ACCEPTED

829,402.—Blackburn and General Aircraft, Ltd., and F. M. Clark.—" Device for locking dropping loads in aircraft."—Oct. 23, 1956.

829,183.—Aerotecnica S.A.—" Rotary-wing aircraft."—Dec. 21, 1955. (April 11, 1955.)

829,401.—Blackburn and General Aircraft, Ltd., and F. M. Clark.—" Means for dropping loads from aircraft."—July 9, 1957. (July 9, 1956.)

Printed specifications of the above will be available on March 2, 1960, and the opposition period will expire on June 2, 1960.

829,753.—Power Jets (Research and Development), Ltd. — " Aircraft." — Jan. 17, 1958. (Feb. 4, 1957.)

829,996.—Link Aviation Inc.—" Image perspective alteration means."—Dec. 29, 1955. (Jan. 5, 1955, April 11, 1955, May 27, 1955, and Nov. 25 1955.)

830,006.—National Research Development Corp.—" Aircraft control means."—Nov. 7, 1957. (Nov. 7, 1956.)

829,873.—English Electric Co., Ltd.—" Temperature control and pressurization system or aircraft cockpits."—Dec. 7, 1956. (Dec. 9, 1955.)

830,072.—National Research Development Corp.—" Aircraft pressure cabins."—April 20, 1956. (April 21, 1955.)

829,816.—Acme Precision Products Inc.—" Aircraft arresting gears."—July 1, 1957.

830,045.—Etudes et Fabrications Aéronautiques.—" Control devices controlling the opening of a parachute container."—Feb. 14, 1957. (Feb. 16, 1956, and June 29, 1956.)

830,232.—Short Bros and Harland, Ltd.—" Jet-deflection device for jet-propelled aircraft."—Feb. 21 1958. (Feb. 21, 1957.)

Aviation Calendar

February 1.—R.Ae.S. Boscombe Down Branch lecture, " Long Range Missiles," by E. C. Cornford, in the Lecture Hall, A. and A.E.E., **Amesbury**, Wilts, at 17.30 hrs.

February 2.—R.Ae.S. Luton Branch lecture, " Development of the Rotodyne," by Dr. H. F. Winney, in the Napier Senior Staff Canteen, **Luton Airport**, at 18.15 hrs.

February 2.—R.Ae.S. lecture, " Suppression of Shock-induced Separations by Boundary Layer Control." by H. H. Pearcey, in the Library, 4 Hamilton Place, **London**, W.1, at 19.00 hrs.

February 2.—British Interplanetary Society lecture, " The Use of Reinforced Plastics in Rockets," by A. Wilson, in the Lancaster Room, Caxton Hall, **London**, S.W.1, at 19.00 hrs.

February 3.—R.Ae.S. Brough Branch lecture, " Production of the ' Saladin ' Armoured Car." by H. J. Nixon, at the Royal Station Hotel, **Hull**.

February 4.—R.Ae.S. London Airport Branch Second Sir Richard Fairey Memorial Lecture, " Naval Aviation," by L. Boddington, in the Senior Mess Club, 4th Floor, B.O.A.C.'s H.Q., **London Airport**, at 19.00 hrs.

February 5.—R.Ae.S. Rotorcraft Section lecture, " Helicopter Operations of New York Airways," by R. L. Cummings, Jnr., in the Library, 4 Hamilton Place, **London**, W.1, at 18.00 hrs.

February 8.—Institute of Transport Brancker Memorial lecture, " R.A.F. Transport Command," by Air Chief Marshal Sir Denis H. F. Barnett, at Jarvis Hall, 66 Portland Place, **London**, W.1, at 17.45 hrs.

February 9.—R.Ae.S. lecture, " Model Testing in the Aircraft Research Association Co-operative Wind Tunnels," by E. C. Carter, in the Library, 4 Hamilton Place, **London**, W.1, at 19.00 hrs.

February 9.—Royal Technical College lecture, " Aerodynamic Aspects of Space Flight," by P. J. Wingham, at the Royal Technical College, **Salford**, at 19.00 hrs.

February 10.—British Institution of Radio Engineers Newcastle upon Tyne lecture, " Instrumentation in Rocket Propulsion," by R. E. Ross, at the Institution of Mining and Mechanical Engineers, Neville Hall, Westgate Road, **Newcastle upon Tyne**, at 18.00 hrs.

February 10.—R.Ae.S. Chester Branch lecture, " Bitumen and its Application to Runways," by G. P. Jackson, in the Lecture Theatre, Grosvenor Museum, **Chester**, at 19.30 hrs.

Personal Notices

BIRTHS

Charlesworth.—On January 16, at R.A.F. Hospital, Wroughton, to Margaret (*née* Fraser), wife of Flt. Lt. Harry Charlesworth—a daughter.

Roberts.—On January 11, at Farnborough, Kent, to Margaret (*née* Hall), wife of Sqn. Ldr. P. H. P. Roberts—a son.

DEATHS

Horry.—On January 15, at Hiwell Close, Birstwith, nr. Harrogate, Gp. Capt. Thomas Stanley Horry, D.F.C., A.F.C., R.A.F. (retd.).

Johnson.—On January 14, Francis Shaw Johnson (late Flt. Lt., R.A.F.), of 44 High View Road, Guildford.

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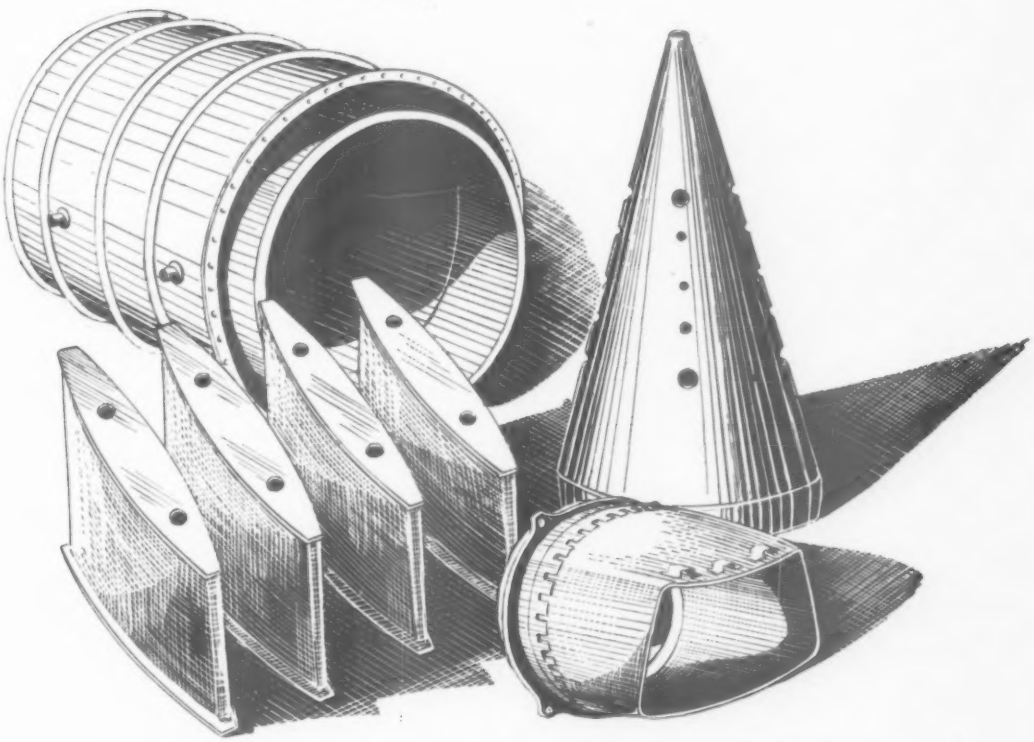

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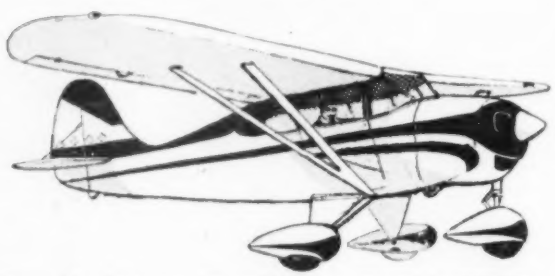

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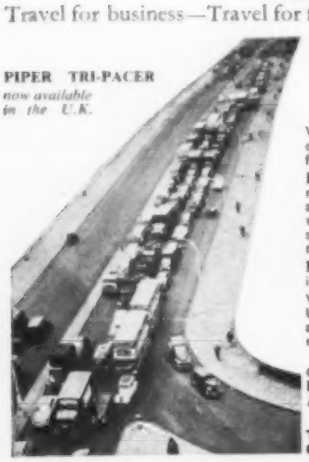

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NOTICES

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THE Air Transport Advisory Council give notice that they have received the undermentioned applications to operate scheduled air services:—

FROM ORION AIRWAYS, LTD., OF BLACKBUSHE AIRPORT, CAMBERLEY, SURREY, for the following Normal Sheduled Services (unless otherwise stated) to be operated initially with Viking aircraft and later also with Viscount aircraft, for the carriage of passengers, supplementary freight and mail, at a frequency of three return flights weekly on each service, for seven years from May 1, 1960:—

APPLICATION NO. 3372 on the route Coventry*-Valley (opt.)-Dublin.

APPLICATION NO. 3373 between Coventry* and Caen.

APPLICATION NO. 3374 for a U.K. Internal Service between Coventry* and Belfast.

APPLICATION NO. 3375 between Coventry* and Marseilles.

* The company also apply to operate these four services from Birmingham until the runway at Coventry is completed.

FROM DERBY AVIATION, LTD., OF DERBY AIRPORT, BURNASTON, DERBY, for the following Normal Scheduled Services to be operated with Viscount and Herald aircraft, for the carriage of passengers, supplementary freight and mail, at a frequency in accordance with traffic demand on each service, for seven years from 1960:—

APPLICATION NO. 3376 on the route Manchester and/or Derby and/or Birmingham-Lisbon (opt.)-Madeira.

APPLICATION NO. 3377 on the route Cardiff and/or Bristol-Lisbon (opt.)-Madeira.

FROM DAN-AIR SERVICES, LTD., of 36-38 NEW BROAD STREET, LONDON, E.C.2—

APPLICATION NO. 3011/1 for permission to operate on the amended route Cardiff and/or Bristol-Liverpool on the U.K. Internal Service which they are at present authorized to operate with Dakota, Bristol 170 and Convair 340 aircraft, between Bristol and Liverpool, at a frequency of three return flights weekly, from April 1 to October 31 each year until October 31, 1966.

APPLICATION NO. 3012/1 for permission to operate on the amended route Cardiff and/or Bristol-Basle, on the Normal Scheduled Service which they are at present authorized to operate with Dakota, Bristol 170, Ambassador and Convair 340 aircraft, between Bristol and Basle, at a frequency of three return flights weekly until March 31, 1967.

APPLICATION NO. 3009/1 for an amendment to the terms of approval of the U.K. Internal Service which they are authorized to operate between London (Blackbushe or Gatwick) and Jersey, at a frequency of two return flights weekly with Dakota or Bristol 170 aircraft or one return flight weekly with Ambassador aircraft on Saturdays from June 18 to September 17, 1960, so as to enable them to operate two additional return flights weekly with Dakota and Bristol 170 aircraft from July 16 to August 6 inclusive and to operate the service at an alternative frequency of three return flights fortnightly with Ambassador aircraft.

FROM BRITISH EUROPEAN AIRWAYS CORPORATION, OF BEALINE HOUSE, RUISLIP, MIDDLESEX:—

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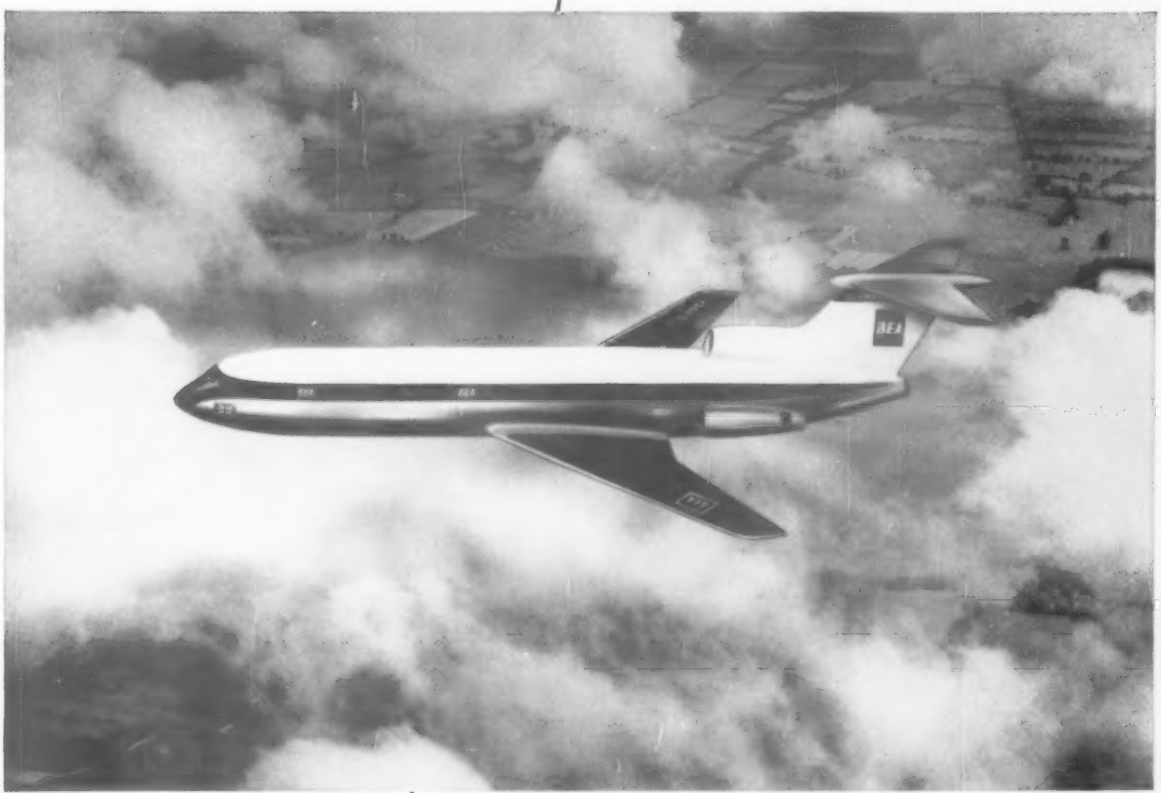

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